HIRD SERIES VOL 56 NUMBER 10 AUGUST 1949

THE JOURNAL OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS

RTLAND PLACE LONDON W1 · TWO SHILLINGS AND SIXPENCE

Work in progress on the South Bank site. From a sketch by E. D. Lyons [A]

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The Town Planning Institute

Sir George Pepler, C.B. [*Hon. A*], has been elected President of the Town Planning Institute for the year 1949-50; he takes office in November next. Sir George was previously President in 1919-20.

R.I.B.A. Exhibitions on Tour

The exhibition of Industrial Architecture, which opened at the Royal Institute during March of this year, and which was on view subsequently at the Scottish Building Centre at Glasgow in May, visited Birmingham for a week from 25 July. The arrangements were in the hands of the Birmingham and Five Counties Architectural Association, and the exhibition was shown at the Birmingham Chamber of Commerce, where a small section was included showing work done in and near Birmingham. The exhibition was opened by Mr. Paul Cadbury, and was well received and excited considerable interest.

The exhibition of Housing Layout, which has been on a tour of a number of large provincial centres, will visit Plymouth and subsequently Exeter during October.

During the last two months the New Schools exhibition touring copy has visited Harrogate, Royston, Nottingham, Leeds and Eastbourne. Subsequent bookings for the autumn include Wells, Blackpool, Redhill and Leyton. A copy of the exhibition has also been on view at the Bouwcentrum, Rotterdam. The exhibition will be retained there a little longer as the Bouwcentrum hope that it may be possible before the conclusion to arrange a special British Schools Day.

A further copy, urgently requested by the Control Commission for Germany, was despatched from this country on 4 August to Hamburg, whence it proceeded to Nuremburg for showing there on 10 August. Arrangements are also in hand for this exhibition to visit other centres in Western Germany and possibly Berlin later in the year.

In collaboration with the British Council, two additional copies were sent to the Middle East, Australia and New Zealand, and two further copies are now being urgently prepared for Canada and Hong Kong.

R.I.B.A. Standard Form of Contract

Practice Notes Nos. 9-18 appear on pp. 460—1. It has been decided by the Joint Contracts Tribunal to publish in pamphlet form all the Practice Notes numbered 1-18, issued by the Tribunal since the publication of the 1945 R.I.B.A. Standard Form of Contract.

Copies of the pamphlet will be supplied *free* to *members* on application to the Secretary, R.I.B.A.

Non-members may obtain copies, price 3*d*. each.

The City Churches

The Diocesan Reorganization Committee of the London Diocese recently announced their proposals for the future of the city churches. Their principal recommendation is that the total number of parishes be reduced from 46 to 15, the parish churches in them consisting of some of the best and most famous of London churches such as St. Bartholomew-the-Great, St. Bride, Fleet Street, St. Stephen, Walbrook, and St. Mary-le-Bow. Eight of them are Wren churches.

Twenty-one other churches, twelve of them by Wren and one a Wren church rebuilt by Hawksmore, are to be called 'ward churches', and particularly associated with the life of the wards in which they stand. These churches are either capable of restoration or have escaped serious damage.

There remain six churches, all by Wren, which were either totally destroyed or were so far damaged as to make restoration impracticable or undesirable. The sites of these will be sold after the ruins have been cleared away. They are St. Andrew-by-the Wardrobe, St. Alban, Wood Street, St. Stephen, Coleman Street, St. Mary, Aldermanbury, St. Swithun, London Stone, and St. Mildred, Bread Street. They are thus to be added to the melancholy list of 19 churches by Wren which have been destroyed by various agencies during the last two centuries. The *Parentalia* lists 54 city churches built or partially rebuilt by Wren after the Great Fire of London. Of these only about half now remain. Discussion of the Committee's proposals is now proceeding with the Corporation of the City of London.

Diploma for Industrial Design

Following the recent establishment of the Royal College of Art as a National College, a new diploma, 'Des.R.C.A.', has been created and will be granted to successful students of the schools of industrial design. There are now six of these schools in the college, namely, the School of Wood, Metals and Plastics (Professor R. D. Russell), Ceramics (Professor R. W. Baker), Silversmithing, Jewellery and Industrial Glass (Professor R. Y. Goodden [*A*]), Textile Design (Professor J. de Holden Stone), Fashion Design (Professor Madge Garland), and Graphic Design (Professor Richard Guyatt). Each of these schools aims to provide a specialized and professional training while continuing to give the student a broad background. Practical experience in the factory workshop or design office is a condition of the award of the diploma. The normal course is of three years with nine months practical experience in addition. The college will also continue as before to teach the fine arts for which the College Diploma of Associateship, known as the A.R.C.A. is awarded.

International Union of Architects

The Executive Committee of the Union Internationale des Architectes met at Gothenberg and Stockholm from 23-31 May under the presidency of Sir Patrick Abercrombie. All the members of the Committee were present, and ten full meetings were held and several meetings of sub-committees. The report of M. Pierre Vago, the Secretary-General, was unanimously approved.

The Committee has accepted the offer of the Minister of Reconstruction and Urbanism of the French Government to provide office accommodation in Paris for the permanent secretariat. All national and regional sections were asked to send to the Secretary-General before 30 November 1949 a report on their organization.

It was agreed to admit provisionally Hungary and Austria to membership. Regarding the request of Iran for admission, the Secretary-General was instructed to ask for further information. The Committee decided unanimously that a Spanish section and a German section could not be envisaged.

The Committee approved the actions of the Secretary-General in relation to recognition by the United Nations and UNESCO, and instructed him to continue the necessary negotiations. It was agreed to send representatives to various conferences, one organized by UNESCO in Paris, two at Geneva, and one in New York.

The Committee decided that individual membership of the Union was inadmissible. The Committee approved unanimously the main lines of the programme of the Congress of the Union to be held at Warsaw in 1950. The Committee is meeting again at Cairo on 9 January 1950.

Industrial Conference Technical Papers

At the time when the Royal Institute held the Conference on Industrial Architecture we had insufficient space to publish in full the excellent papers which were delivered at the technical session. Those papers were by leading experts, and some of them were valuable expositions of the latest knowledge and practice in their particular fields. We accordingly decided to publish a selection of them during the summer months, after the close of the R.I.B.A. session.

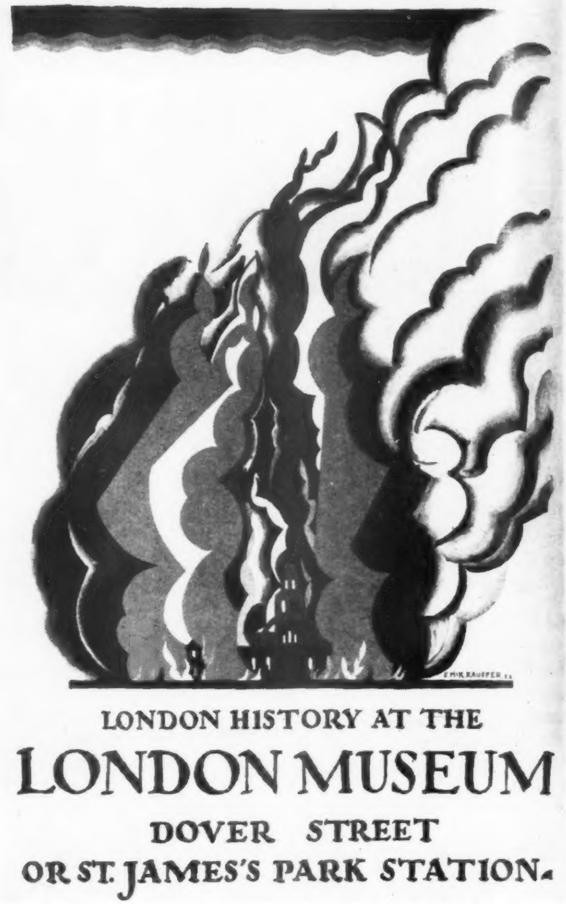
The first of these, *Thermal Insulation in Building*, is published in this JOURNAL. The author, Mr. A. G. Sutton, has expanded his original thesis which covered industrial buildings only, to include insulation practice in other types of buildings, notably housing. The second part of his paper will be published in the September JOURNAL in which will also appear Mr. W. S. Atkins's paper on *Structural Techniques in Industrial Architecture.*

Experts on Furniture Design—July Conference at R.I.B.A.

Designers, manufacturers, retailers, scientists and technicians from all parts of the country attended a conference on furniture design organized at the R.I.B.A. by the Council of Industrial Design from 8-22 July. The conference took the form of a symposium of lectures and papers on the many factors governing furniture design. Some pieces of furniture were on show in the foyer, including several of the winning designs in the recent competition organized by the Scottish Committee of the Council of Industrial Design, which have so far been seen only in Scotland; also exhibited was a selection of books on furniture and related subjects. Among the speakers were Sir David Waley, Chairman of the Furniture Development Council; Mr. Jack Pritchard, Director and Secretary of the Furniture Development Council; Mr. Gordon Russell, Director of the Council of Industrial Design; Mr. R. D. Woods, of the Timber Development Association; and Mr. Mark Hartland Thomas, M.A. [*F*].

New R.I.B.A. Exchange Telephone Number

The exchange of the R.I.B.A. telephone number has been changed from WELbeck 5721-7 to LANgham 5721-7, the number remaining unaltered. This took effect from Saturday 13 August.



From the recent London Transport exhibition of posters at the Victoria and Albert Museum. A design by E. McKnight Kauffer.

A.B.S. Tombola

Enclosed with this JOURNAL is a loose inset about the A.B.S. Tombola to be held at the forthcoming Building Exhibition, and which was announced in the June JOURNAL. Please do not defer looking out and sending off your gift; the earlier you send it the less will be the strain on the organizers in dealing with the many hundreds of gifts which are likely to arrive in the last month.

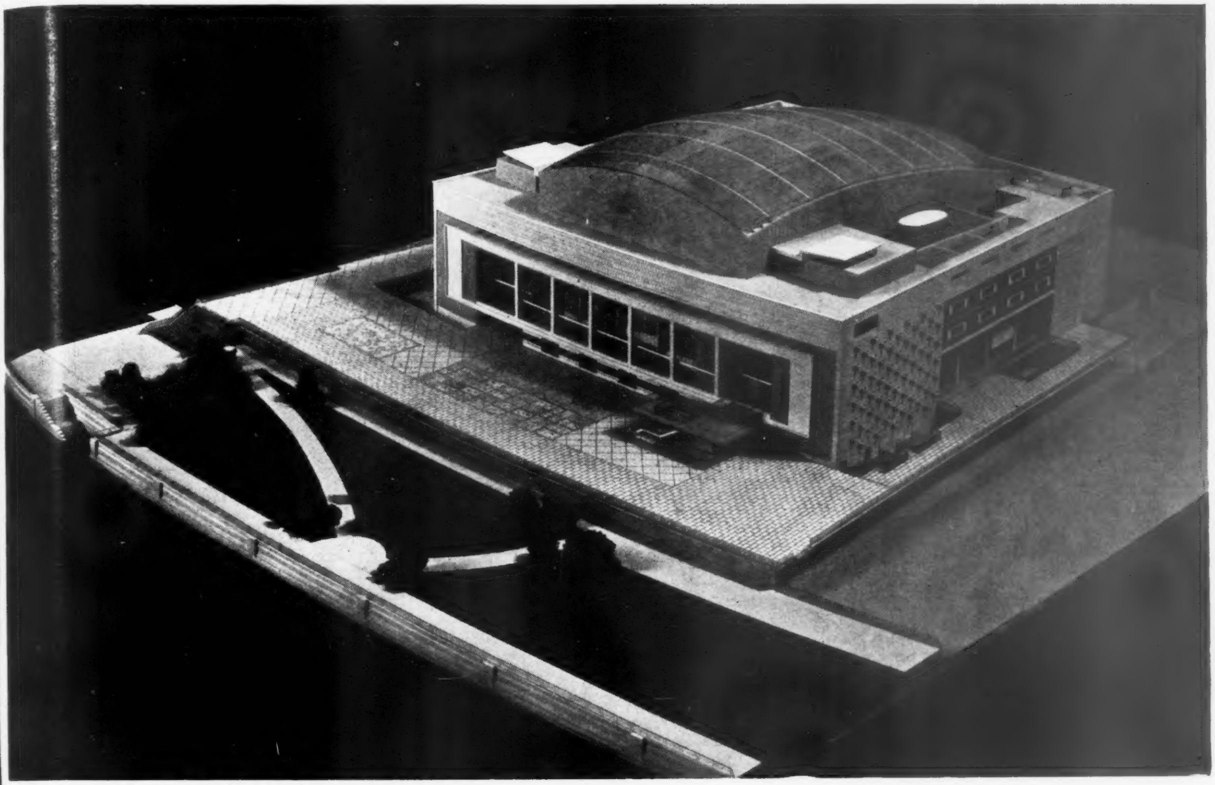
Building Research Board

The Department of Scientific and Industrial Research announce a change in the chairmanship of the Building Research Board, on the retirement of Sir George Burt, M.I.C.E., who had been a member of the Board since 1927, and was appointed chairman in 1939.

The new chairman of the Building Research Board is Mr. W. K. Wallace, C.B.E., M.I.C.E.; he was appointed to the Board in 1940.

Painting, Sculpture and the Architect

A meeting is to be held at the R.I.B.A. on 6 September at 6 p.m. to discuss the relation of the architect to the allied arts. It is being organized jointly by the MARS Group and the Institute of Contemporary Arts; Mr. Gerald Barry [*Hon. A*] is to take the chair. The speakers will include Mr. E. Maxwell Fry [*F*], Mr. J. M. Richards [*A*], Mr. Leon Stynen, Director of the School of Architecture at Antwerp, and M. Ernesto Rogers. The meeting will be followed by a garden party in Bedford Square at 9 p.m.



View of the model showing the river front and terraces

The London County Council Concert Hall

Architect to the Council: Robert H. Matthew [*A*]

THE NEW LONDON COUNTY COUNCIL Concert Hall is Britain's first post-war non-austerity and non-essential building. Inspection of the drawings and a visit to the already busy site—easily overlooked from Hungerford Bridge—reveals a monumental building in course of erection, a fact that is stimulating to an austerity-ridden architectural profession. Here is the first effort at that large-scale, fine public building for which British architects have been longing since the end of the war.

THE PLANNING AND DESIGN

A concert hall with accommodation for 3,500 persons, plus a small theatre-type hall, picture gallery, meeting rooms and ancillary buildings to be, after the County Hall, the first of a group of new buildings on the south bank of the Thames comprises a stimulating programme. The site, however, has two severe restrictions: it is limited in area and there is a difficult problem in noise exclusion resulting from the close proximity of Charing Cross railway bridge and the river steamers with their hooters. The present rationing of steel acts as a third restriction in enforcing the use of reinforced concrete construction. The building has to be completed in time for the 1951 Exhibition which full steel frame construction, being more quickly erected, would have ensured. The amount of steel allocated is insufficient for this; therefore to make completion in time more certain the theatre, picture gallery, meeting rooms and some ancillary rooms have been temporarily omitted; the omission amounts to about one-sixth of the whole project.

The plans and sections here reproduced are of both the full and temporary schemes. All the plans of the full scheme are reproduced together with two principal plans and a section of the present scheme, enough to show the differences between the two.

The dual acoustical problem, namely auditorium acoustics and noise exclusion, is under the charge of Mr. Hope Bagenal [*F*] and Mr. William Allen [*A*], who are acting as the acoustical consultants. Mr. Allen is a member of the staff of the Building Research Station, where very considerable advances in both aspects of acoustics research have been made during the last few years. This recently acquired knowledge is being used in the design of the concert hall. A description of the acoustical design, by Mr. Allen, is printed on pages 436 to 438.

There are two principal acoustical items which affect the planning and construction. The first is that the auditorium has a rectangular plan instead of a fan-shaped one. Readers will recollect that the merits and demerits of various concert hall plan shapes were argued by Mr. Bagenal at the discussion on Concert Hall Acoustics reported in the JOURNAL of December 1948, and that he advanced arguments in favour of the rectangular plan, in spite of it being relatively restrictive of seating accommodation. The second item is the construction of the auditorium with a double skin—walls, roof and floor—as the primary defence against external noise.

Site restriction has brought about the placing of the large areas of circulation space, cloakrooms, restaurants, etc., beneath the main auditorium (see sections). The form of the building is, therefore, an enclosed auditorium box on tall 'legs' with foyers, restaurants, etc., arranged on

'shelves' supported on and cantilevered from the legs. In addition there are two towers of grouped escape staircases and lavatories at the north-east and north-west corners, and in the final design the superimposed block of the theatre and exhibition rooms on the south side.

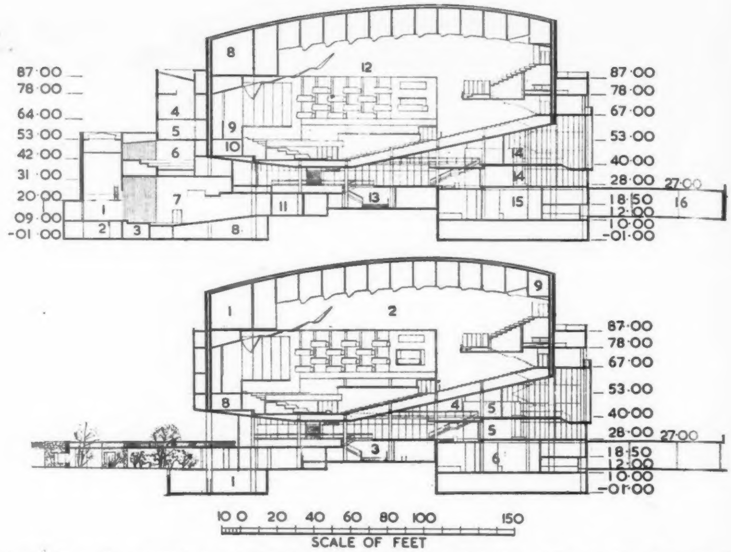
Except for these three enclosed corner blocks the whole of the interior beneath the main auditorium is open, practically all subdivision being by glazed screens only. Thus when the foyers are illuminated, it will be possible to look into the heart of the building from outside and to appreciate its structural anatomy. Indeed, the effect of the building when illuminated has been specially considered in the design. The average building at night presents an irregular pattern of lighted windows; alternatively, façades may be floodlit or picked out with external lights. This conception of a building designed and lit as an object to be seen *into*, together with the placing of certain openings to spill light on to parts of the façade, is something new. This novel feature of the design is not readily appreciated from the drawings or the photographs of the model.

The seating accommodation of the concert hall is 2,900 in two main tiers which consist of the ramped floor of the auditorium and a gallery with side boxes. The choir seating of 250 will also be available to the public on many occasions and there is standing space in the side galleries for 300, thus giving a total accommodation of 3,450. It will be noticed in the sections that there is no stage, the lowest part of the orchestra seating being only slightly above the actual floor of the auditorium.

An organ, for which the specification has been prepared by Dr. Downes, is situated at the back of the orchestra space. The design is unusual and attempts to recapture the qualities of the 18th century type of instrument for which much organ music, notably by Bach and Handel, was composed, but at the same time to give the fullest facilities for the performance of contemporary music.

Suspended over the orchestra space will be a heavy timber sounding board, slotted to admit the powerful downward lighting for the orchestra—one of the many considerations which have been given to the comfort and convenience of the artistes. There will be no local orchestra lighting. The control of the lighting has been so arranged that when the audience enters, the main auditorium lights (in ceiling slots) will be fully on and the orchestra lighting dim. As the conductor enters, the orchestra lighting will be increased to the maximum while, at the same time, the auditorium lighting will be dimmed down to a degree making possible the reading of scores by members of the audience. Part of the sounding board is hinged to hang downwards over the organ when this is not in use.

The principal external facing material will be Portland stone with contrasting areas of other materials such as granite. The facing materials will extend into the building, emphasizing the openness of the plan and the effect of being able to look into



Upper section, the complete scheme. Key: 1, Stage. 2, Electrical shop. 3, Stage basement. 4, Exhibition gallery. 5, Changing room. 6, Orchestra practice room. 7, Theatre. 8, Ventilation. 9, Organ. 10, Practice room. 11, Theatre. 12, Auditorium. 13, Lower foyer. 14, Restaurant. 15, Wash up. 16, Car park

Lower section, the 1951 scheme. Key: 1, Ventilation. 2, Auditorium. 3, Lower foyer. 4, Refreshments. 5, Restaurant. 6, Wash up. 7, Car park. 8, Practice room. 9, Projection

the building. This is a departure from the customary practice of having an external facing material ending at the glass faces of windows from which an internal facing material (e.g., plaster) continues inside the building.

The main foyer is planned as promenade space, equipped with its own bar, and may be used either for concert hall purposes or for other uses such as receptions. Adjoining the main foyer and overlooking the river is restaurant accommodation on two floors for 700 people. Various portions could be used separately; for example, a restaurant for 300 and a small dance floor could be made available for letting, while a separate restaurant serving meals to the general public was kept in operation. Both foyer and restaurant have direct connection with the terrace and riverside gardens.

The small hall, with seating for 750, is planned for chamber music, ballet, cinema projection, dramatic performances, etc. The exhibition suite has 7,200 sq. ft. of exhibition space. There are two meeting rooms, usable for lectures, etc., with seating for 200 and 100 respectively.

An underground car park for 50 cars will be provided beneath the terrace. There will also be ample surface car parks adjacent to the building after the 1951 exhibition is over.

The senior staff in the Architect's Department of the Council associated with the scheme are:

Robert H. Matthew [*A*], Architect ;

J. L. Martin, M.A., Ph.D. [*F*], Deputy Architect ;

Edwin Williams, M.B.E., M.A., B.Arch. [*F*], Senior Architect ;

Stanley H. Smith [*A*], Principal Assistant Architect ;

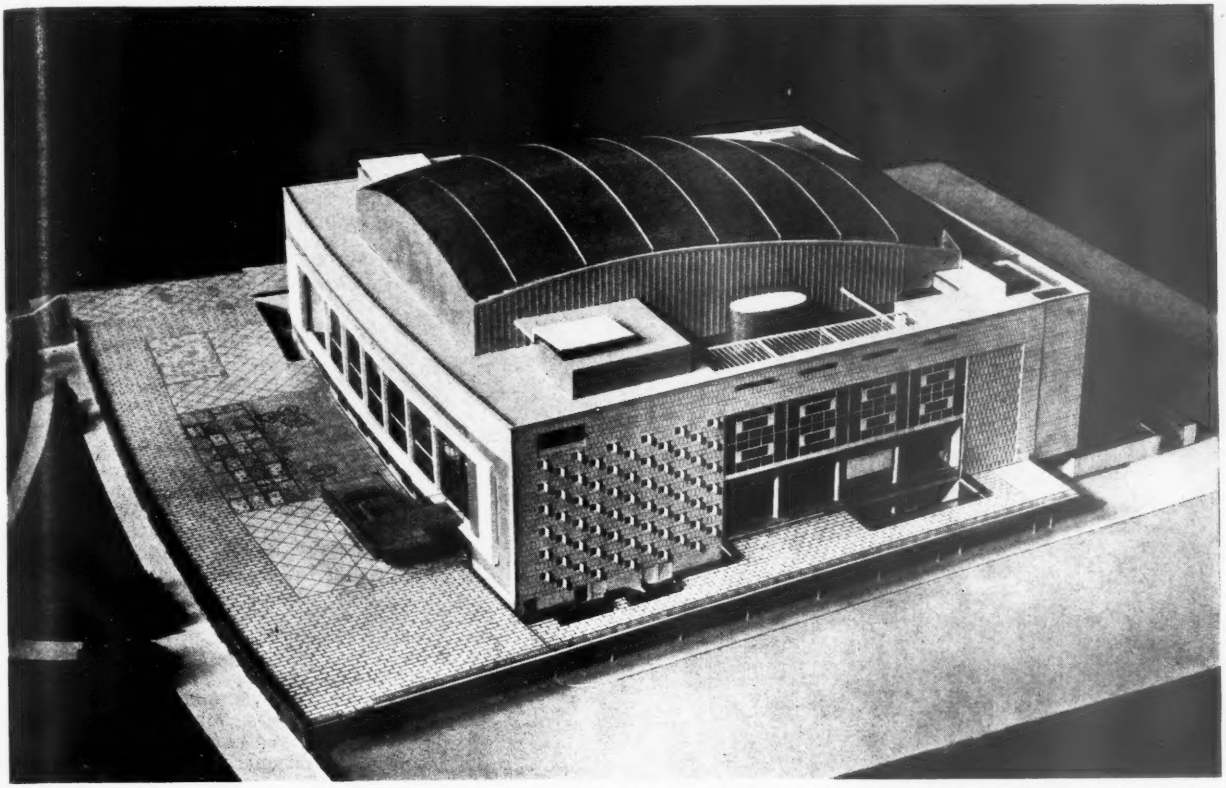
Peter M. Moro, Dip.Arch. [*F*], Associated Architect.

Architectural Assistants: T. W. Bliss, J. S. Cousins [*A*], J. T. Dannatt, Dip.Arch. [*A*], G. W. Dunton [*A*], W. E. Greaves [*A*], A. J. Hepworth [*A*], M. H. Kenchington [*A*], R. A. Laker, J. M. Lakin, B. A. Le Mare, Dip.Arch. [*A*], J. L. Mayo, Dip.Arch. [*A*], P. K. Nicoll, F. L. Peatfield [*A*], Miss B. M. Price, M.A., A.A.Dip. [*A*], J. W. G. Smith.

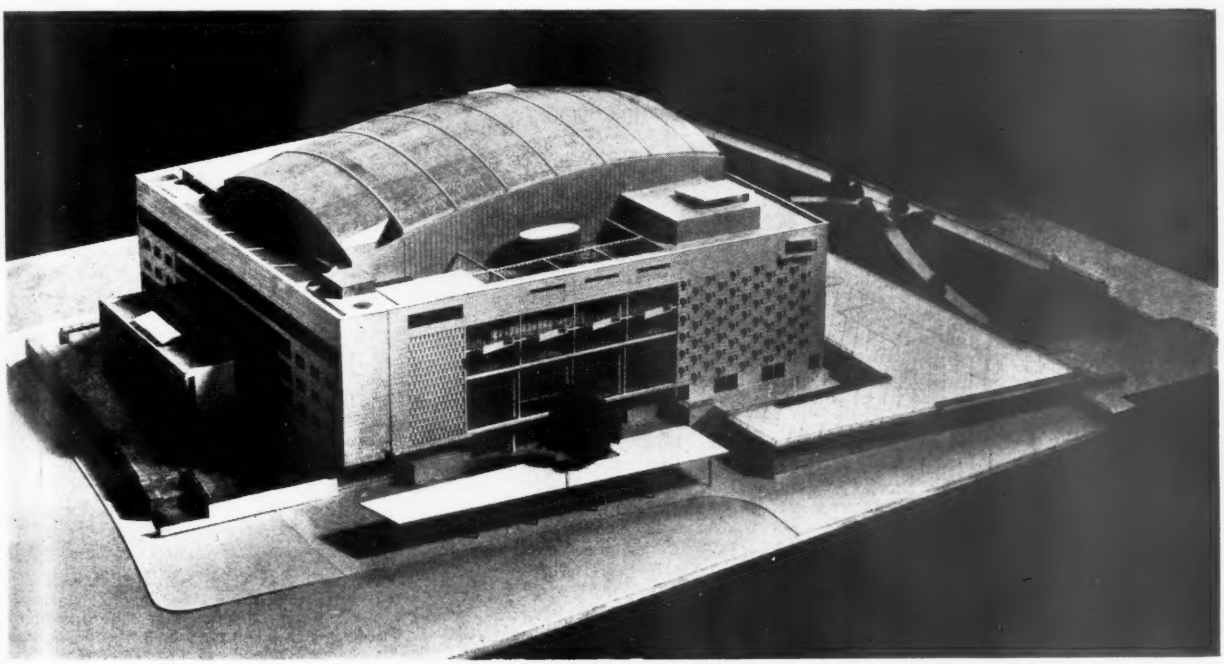
THE STRUCTURE and MECHANICAL EQUIPMENT

The consulting structural engineers are Messrs. Scott and Wilson. Their main problem has been to design a novel construction which embodies the very special acoustic requirements, which carries a total auditorium load of 22,000 tons on tall columns and which can be constructed quickly. These factors have very strongly conditioned the design.

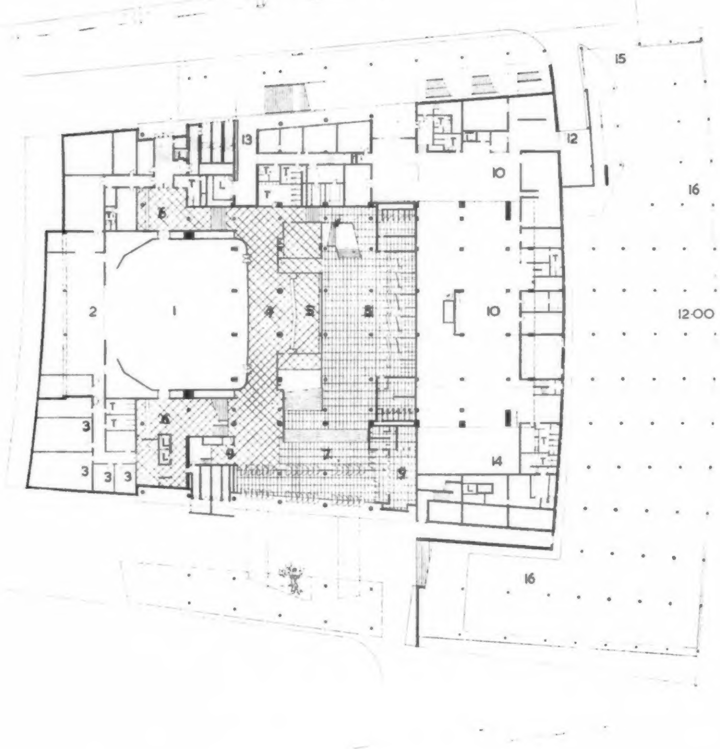
The 'box' of the auditorium has cavity walls of reinforced concrete, each leaf 10 in. thick with a 12-in. cavity. The double floor consists of a sloping slab (the ceiling of the foyer) and the stepping for the seating. On top of the walls are 12 bow-shaped lattice steel trusses. These are not carried on stanchions but bear on the inner leaf of the walls; their principal function, however, is to act as permanent centering for the r.c. roof and to support the heavy ceiling ($2\frac{1}{2}$ to 3 in. thick), the ducting for the air conditioning and the lighting equipment. The roof is not of shell construction, as might be supposed from a casual glance at the model, but is a concrete arch, the ties being provided by the bottom chords of steel trusses, and consequently it exerts no thrust on the walls. The inner skin of the roof is 6 in.



View of the model showing the building from the north-west. The principal facing material is to be Portland stone. The details of the elevations are not yet finally decided. One of the partially covered roof terraces, accessible from the balcony foyer, can be seen.



View of the model showing the building from the south-east or as it will appear from the top of the shot tower. The main entrance is on this side



The complete scheme. Plan at 12 ft. level. Key: 1, Theatre. 2, Stage. 3, Changing rooms. 4, Theatre foyer. 5, Theatre cloaks. 6, Theatre bar. 7, Lower foyer. 8, Concert hall cloaks. 9, Ticket office. 10, Kitchen and stores. 11, Kitchen staff. 12, Goods entrance. 13, Instrument entrance. 14, Plant and services. 15, Car park entrance. 16, Car park. T, Toilet. L, Lift

thick and on it is constructed the outer skin, 4 in. thick, with a 12-in. cavity. An important feature of the whole of this double skin construction of walls, floor and roof is that at all points where the inner and outer skins touch one another, pads of asbestos felt are inserted to reduce the transmission of sound. These points are illustrated in the section drawing on page 436, which has been made from a working drawing of the consulting engineers.

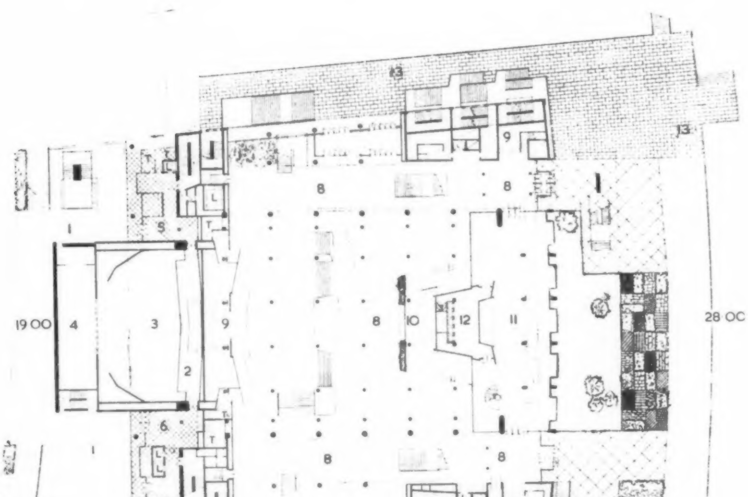
The extension under load of the bottom chords of the steel trusses would cause a thrust to be exerted on the walls. This thrust is small near the centre of the length of the walls where the free height is considerable, and it can, therefore, be neglected here, but near the corners where the walls are restrained by the return walls and by the balcony at one end, the thrust would be so large that it could not be neglected. Jacking devices have, therefore, been incorporated in the bottom chords of the three girders at each end so that the bottom chord can be shortened and the thrust exerted upon the top of the wall thus kept within desired limits.

Sound might travel by way of the columns between the concert hall and the theatre. Therefore, where the columns pass through the back of the theatre, they are built as separate concentric constructions separated by sound-insulating material. The inner column carries the concert hall and the outer column the theatre structure.

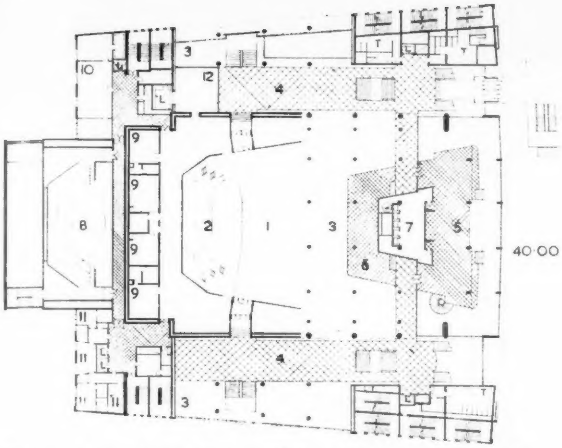
The balcony construction is another unusual feature of an unusual design. The traditional main balcony girder with cantilevers in front and raking beams behind is not used. Instead, the main supporting member is designed as a torsion tube in reinforced concrete with short cantilevered portions in front and behind.

The main reinforced concrete columns are of various sections, the largest being 9 ft. by 3 ft. in cross section and carrying 2,002 tons. Their load is taken down to foundations, some mass concrete, some reinforced, to a good ballast bottom taking 3 tons per sq. ft.

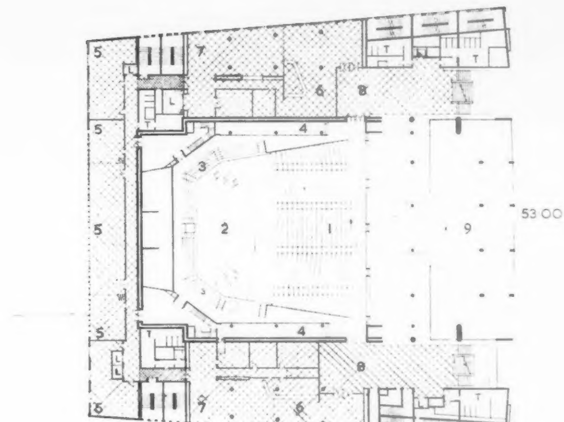
Another departure from traditional methods can be observed at the present time in the method of excavation. The bottom of the excavation is well below the high-water mark of the river and the ballast overlying the London clay is fully charged with water. Again traditional methods have not been used. These would



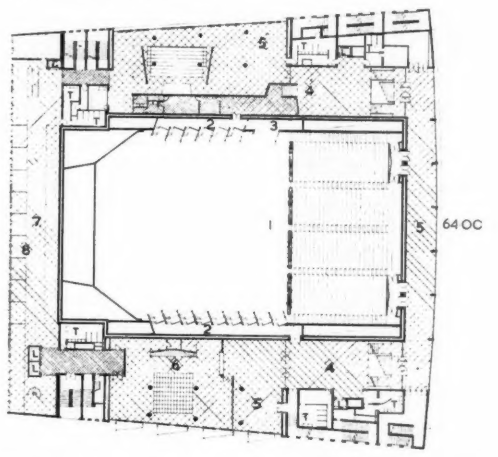
The complete scheme. Plan at 28 ft. level. Key: 1, Terrace. 2, Theatre balcony. 3, Upper part of theatre. 4, Upper part of stage. 5, Entrance hall, artists. 6, Entrance hall, theatre. 8, Main foyer. 9, Cloaks. 10, Bar. 11, Restaurant. 12, Restaurant service. 13, Terrace. T, Toilet. L, Lift



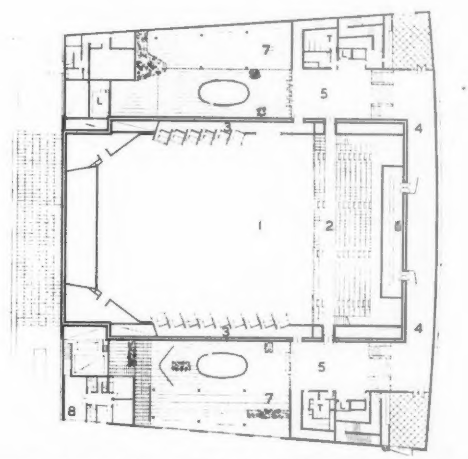
The complete scheme. Plan at 40 ft. level. Key: 1, Auditorium. 2, Platform. 3, Upper part of foyer. 4, Promenade. 5, Upper restaurant. 6, Balcony buffet. 7, Restaurant service. 8, Orchestra practice room. 9, Practice rooms. 10, Library. 11, Conductor and soloists. 12, Instrument store. T, Toilet. L, Lift



The complete scheme. Plan at 53 ft. level. Key: 1, Auditorium. 2, Platform. 3, Choir seating. 4, Promenade. 5, Changing rooms. 6, Bar. 7, Orchestra and choir lounge or meeting room. 8, Upper foyer. 9, Upper part of restaurant. T, Toilets. L, Lifts



The complete scheme. Plan at 64 ft. level. Key: 1, Auditorium. 2, Boxes. 3, Royal box. 4, Foyer. 5, Promenade. 6, Meeting hall. 7, Exhibition gallery. 8, Balcony over exhibition. T, Toilet. L, Lift



The complete scheme. Plan at 78 ft. level. Key: 1, Upper part of auditorium. 2, Auditorium balcony. 3, Boxes. 4, Promenade. 5, Foyer. 6, Cloaks. 7, Terrace. 8, Caretaker's flat. T, Toilets. L, Lifts

have consisted of sheet piling the perimeter, strutting the sheet piling off the central dumpling, constructing retaining walls and then removing the dumpling. Instead a dewatering system has been used. This consists of a 'fence' of steel pipes driven down into the ground round the perimeter of the site and connected by header pipes to pumps. The pipes contain strainers and thus only water is pumped. Removal of water only (and not silt) avoids settlement or movement of the subsoil. The dewatering system lowered the level of the ground water in the site by 11 ft. in four days and has kept the excavation quite dry since then.

The site has been excavated by mechanical excavators, one of them having a 5-ton capacity and said to be the largest ever used in London. At the time of writing, part of the foundations and lower walls are being poured; two concrete pumps are in use and work is proceeding in two 10-hour shifts.

The heating and air-conditioning equipment has been designed by the Heating Section of the Architect's Department. The electrical work and boilers are designed under the supervision of Mr. J. Rawlinson, Chief Engineer to the London County Council. This has been arranged so that any one of the many sections of the building can be individually operated: there is a central boiler room with gas-fired boilers providing low pressure hot water. The foyers, restaurants and other public rooms are warmed by floor panels giving a maximum floor temperature of 80 degrees F.

The auditorium is warmed and ventilated by two air-conditioning plants, provided with speed variation and having a capacity of 1,250 cu. ft. of air per person under normal conditions. The plant has been designed with a view to incorporating refrigeration at a later date to enable full air-conditioning to be provided. This will allow the total air supply to be increased by means of recirculation to 1,875 cu. ft. per person per hour. The chilled air for cooling would be supplied by a separate refrigeration plant or from a heat pump which the Ministry of Fuel and Power propose to erect on the site as an Exhibition unit.

The air will be brought into the building high up on the south side through a long tunnel fitted with sound absorbents. It will be introduced into the auditorium at ceiling level and extracted under the seats of the balcony, main floor and the orchestra and choir platform.

The general contractors are Holland & Hannen and Cubitts, Ltd.; the sub-contractors for the excavation are Willment Bros.

The Acoustics of the London County Council Concert Hall

By William Allen [*A*]

Mr. Hope Bagenal [*F*] has been retained by the Council to advise their architect on acoustics, and the Building Research Station is collaborating in detail.

The Shape of the Hall. At the beginning of the work an immediate decision had to be made about the main shape of the hall. In plan, the arguments for and against a fan-shaped hall or one with parallel sides were reviewed. They are somewhat intangible. The evidence from existing halls suggests that halls which are good for 'singing tone' have parallel sides, and those which have good 'definition' are fan-shaped. It is important to note, however, the arguments are by no means certain, and are unlikely to be resolved for at least a year or two. The new Queen's Hall, which is expected to be built at the same time as the L.C.C. Hall, is, of necessity, a splayed plan, and since it will in most other respects be similar acoustically, it is hoped that the comparison will enable some more definite guidance to be obtained.

In section, something approaching a revolution has taken place. In Post-war Building Study No. 14, on Sound Insulation and Acoustics, it was recommended that in order to obtain good direct sound paths from all parts of the orchestra to all parts of the audience, both the seating area of the audience and the stage for the orchestra should be well ramped. The argument for this was that if the direct path from each part of the orchestra is good, the balance as between one part of the orchestra and another should be good, and less trouble would be likely from minor echoes or poor decay characteristics. In other words, it is an insurance policy. In the L.C.C. design, this new approach has been adopted. The seating of the audience has been established according to a formula recently determined by continental investigators in touch with the Building Research Station, and the orchestra platform starts only a foot or so above the main floor level and rises at about an equal angle.

The orchestra platform has not been finally established yet, but the suggestion is that a space sufficient to accommodate two pianos and the conductor will be cut out of the platform in the centre in order to ensure that the pianos do not screen players behind them. This has an additional advantage that the pianos can be moved out on the main floor area with the minimum of labour. Then a width of platform sufficient to hold a desk of fiddles occurs at the first level all the way across the front except for the piano recess. Then a succession of lifts occurs, arranged to ensure flexibility and convenient seating for the orchestra, who must be able to face the conductor. The piano recess will be able to be filled in if desired.

The space between the orchestra and the seating will be finished in marble as a reflector. The reflectors overhead have been subject to extensive discussion. It is possible to advance arguments that they are not needed at all, as evidenced by successful halls without them. It is possible, also, to advance arguments that they should be developed so that in the main contour they diffuse sound. It is also possible to argue that they should form a concave reflector designed to direct the sound to the back of the hall. The arguments are impossible to resolve on a strictly scientific basis. The decision has been made to set them out so that the main contour is a concave directing the sound—especially the high frequencies—towards the rear of the hall, but each of the four elements in the reflector are convex, so that some dispersion takes place.

It will be observed that flat areas are arranged between the elements of the reflector to reflect the orchestral sound back to the players. It has been observed in some modern concert halls that the players do not have sufficient sound back from nearby surfaces. It seems to be necessary, it is said, to help them to play as a body and to gain more strength of tone.

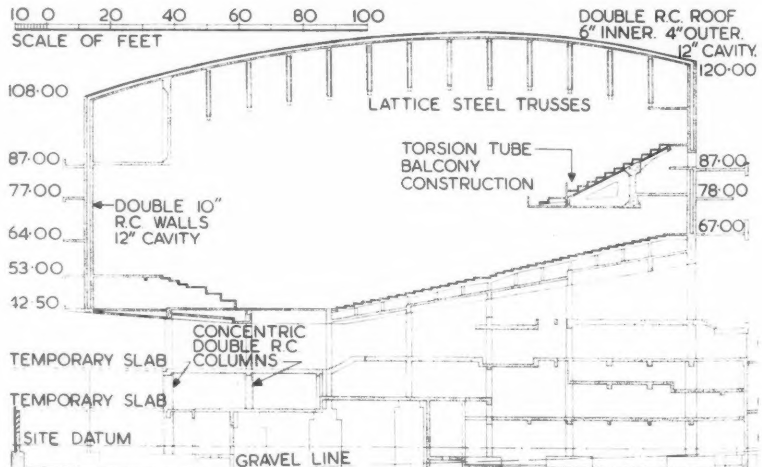
The reflectors are admittedly very high—considerably higher than was desired. It was however argued on behalf of the organ consultant, that the opening for the organ should be very large, and in order to ensure this the whole of the reflectors had to be set well up. The lowest element of the reflector is designed to be hinged and drawn up when the organ is in use. This has enabled the reflectors to be brought down to what is hoped to be a safe point above the orchestra.

The splayed parts of the plan on either side of the orchestra do not play an important part in the acoustics of the hall so far as can be judged at the present time.

Internal Finishes. Having determined the shape of the hall in such a way that the direct sound paths are good, the problem is to ensure that the sound energy decays in a manner which will be satisfactory. It is not known exactly what the term 'satisfactory' means yet; but the Building Research Station has undertaken studies of a number of important halls in this country to determine the physical characteristics, and so far as possible, to correlate these with subjective impressions of quality obtained by systematic listening studies. It is believed that this is the first such comprehensive review in auditorium acoustics, and it has led already to a fairly clear view of the desirable attributes of a hall.

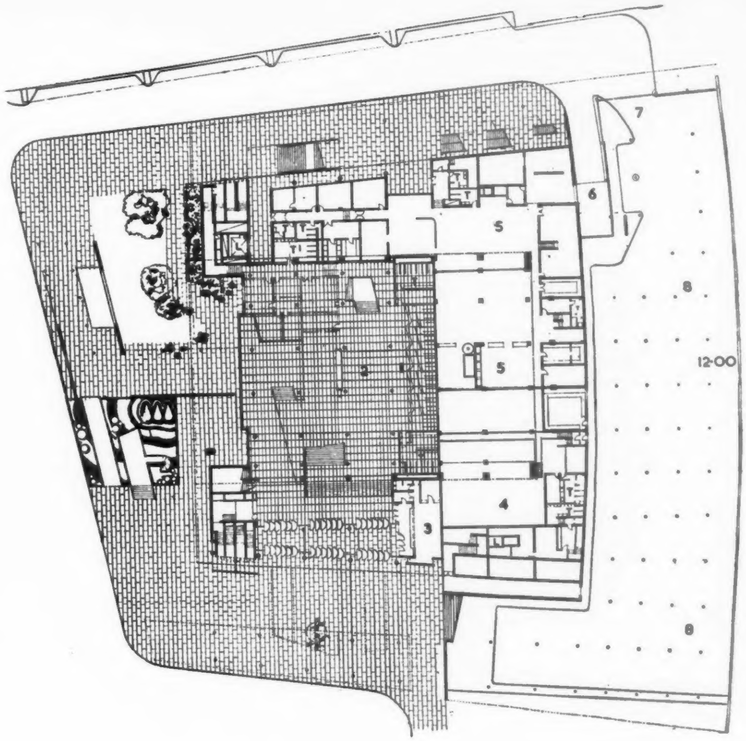
The essential points appear to be a fairly long reverberation time, rather longer at low frequencies than at middle pitch, and as long as possible at the higher frequencies. At middle pitch the present intention is to have the reverberation at the optimum point laid down by Bagenal and Wood. It is somewhat longer for a hall of this size than the times in existing British halls, and is also longer than the optimum assumed for American concert halls. It is known that American and Continental listeners differ in their desires on this point.

The construction of the hall is very solid and robust, and if special measures for bass absorption were not taken the hall would, in fact, have excessive reverberation at these low frequencies. Low frequency absorption is provided by extensive areas of panelling on the side walls. The panels comprise plywood, probably ⅜ in. thick, with an air space behind varying from 1 in. to 3 in. to ensure that absorption is spread over an adequate frequency range. Some areas of the panelling will be perforated,



Section showing the construction; from a drawing of the consulting engineers. The double construction of the walls, roof and floor are shown, the torsion tube balcony construction and the concentric double columns. The auditorium ceiling is omitted. For description see pp. 432-4

The 1951 scheme. Plan at 12 ft. level. Key: 1, Concert hall cloaks. 2, Lower foyer. 3, Ticket office. 4, Services plant, etc. 5, Kitchen and stores. 6, Goods entrance. 7, Car park entrance. 8, Car park. T, Toilet. L, Lift



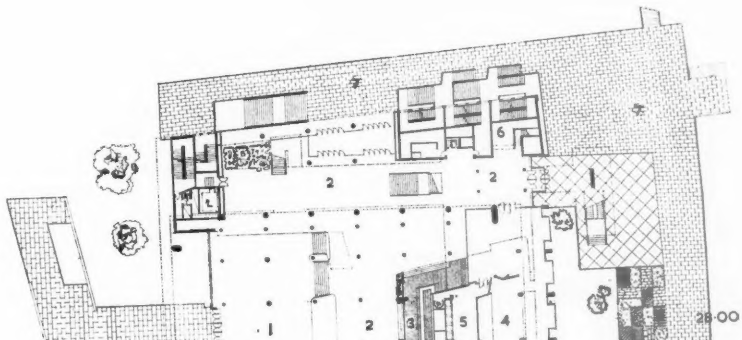
which will provide some absorption at middle frequencies as well as a lower range, and in some cases the perforated panels will rest directly against glass silk in such a way as to provide principally mid-frequency absorption. It is important to avoid high frequency absorption, because the air absorbs high frequencies readily, as also, of course, does clothing and upholstery.

At the same time the quality of sound and much of the tone and the characteristics of individual instruments depend on high frequencies. For these reasons no absorbent at high frequency is proposed, except in small areas necessary to avoid reflections. No carpets are intended, for instance, and none of the familiar types of sound absorbents. The only area of high frequency absorbent is along the margin of the ceiling and the top of the wall where long reflections could cause disturbing echoes. Here it is proposed to use 2 in. wood wool with an air space behind to absorb efficiently over the whole range of frequencies.

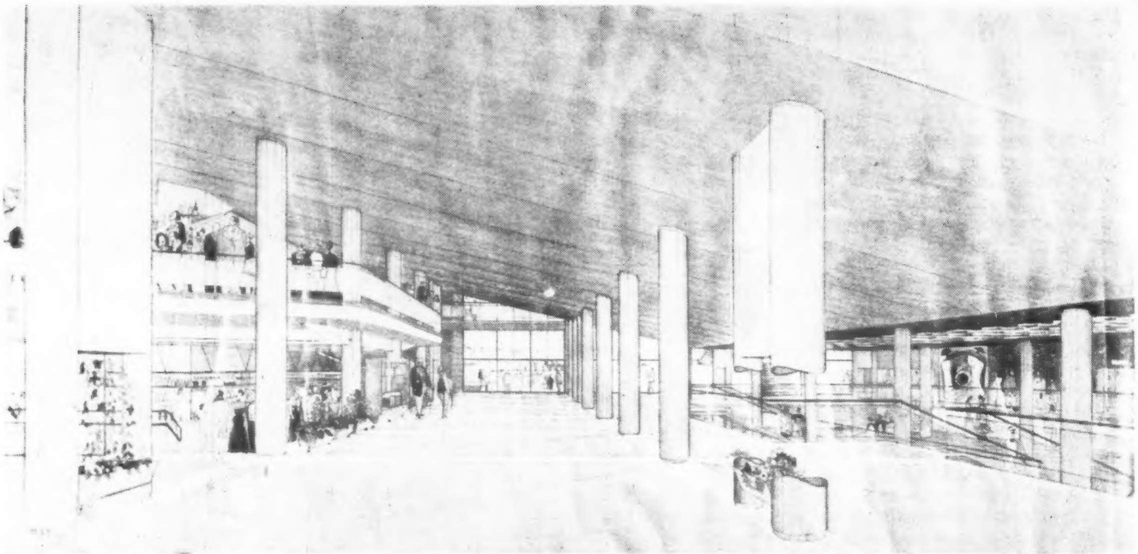
The ceiling construction is robust. It has been observed in some halls that plaster on metal lath can produce disturbing resonances. In this hall, therefore, the ceiling, which is an important reflecting area, is being built in a 2 in. thickness of solid material and divided into units to provide further insurance against resonances.

The contours of the ceiling have been determined principally on other grounds than acoustics.

There is some danger, naturally, of standing waves or flutter echoes between floor and ceiling. These have occurred in Continental halls and are known in British halls also. They occur at single frequencies related to the distance between two surfaces. It is possible to reduce them by what are known as Helmholtz absorbents, which can be tuned to absorb precisely at the frequency of the standing wave. For this purpose a large number of wooden blocks are being left in the structure of the ceiling, which can, if necessary, be drilled out and replaced by small resonators to tune out any desired frequency. On the lower part of the side walls, below the first promenade, there is an area of ribbed finish commonly known in this country as Copenhagen absorbent, because of the place where it was developed. It consists essentially of thin wood ribs spaced a short distance apart with an air space behind filled with glass silk. Technically, this would form a type of perforated absorbent in which the perforations are slits. They are effective over a fairly wide range of frequency, and it is hoped that they will avoid 'side to side'



The 1951 scheme. Plan at 28 ft. level. Key: 1, Semi-foyer. 2, Main foyer. 3, Sunken bar. 4, Restaurant. 5, Restaurant service. 6, Cloaks. 7, Terrace. T, Toilet. L, Lift



Perspective of the main foyer at the 28 ft. level (see lower plan on page 434). The sloping ceiling is the soffit of the floor of the main auditorium. Entrance is from the lower foyer on the right

echoes which otherwise often cause trouble in wide halls in the front seating areas. For instance, trombones or horns on one side would be reflected from the opposite wall back to the seats on the same side as the instruments, with a path so much longer than the direct path as to cause an echo.

The orchestra platform is to be constructed in wood with a space below, except for the top platform, which is to receive the drums. This will be made of concrete to avoid resonances which have occasionally been observed as a source of annoyance. The orchestra and choir will be separated by a removable screen, which it is hoped will help nearby players by providing some local reflection.

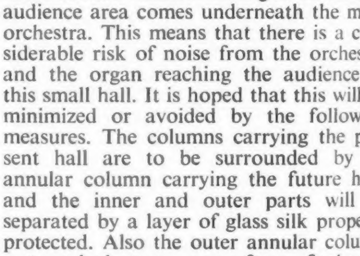
This completes the review of the chief internal finishes.

An important innovation is a period allowed for the design of the hall after the structure has been substantially finished. It being still impossible to predict exactly the whole of the acoustical characteristics of a hall, it is necessary to provide for initial measurements and studies which may lead to some readjustment of the internal finishes before the hall is put into full use; for this purpose important areas of panels are removable.

Insulation. The chief problem in insulation is, of course, the reduction of the noise of trains passing over nearby Hungerford Bridge. The intensities of low frequency sound from the bridge are very great, and no certain method of reducing them at the source is known. Therefore, it has been necessary to rely only on structural measures in the hall itself. Measurements on the site of the hall have shown that the intensity at 100 cps. is about 100 db., which is about twice the loudness of the noise inside a tube train. From measurements of the noise levels inside concert halls it has been possible to deduce the amount of insulation which should be provided at the structure, and this amounts to some 70-80 db. at a frequency of about 100 cps. The main protection is provided by a double outer wall consisting of two heavy leaves and a considerable space between, and an absorbent lining to the air space. The roof is similarly protected with double leaf construction consisting of an outer concrete screen resting on insulated dwarf walls. At the bottom of the walls the two leaves join together, but it is thought that the length of this path will be such as to ensure a reasonable attenuation, because the lower parts of the building are protected by the outer case containing the foyer, restaurant and public space.

The main walls and roof have to be perforated in a number of places for ventilation, and this has made necessary major precautions to attenuate low frequency sounds by other measures, the main method being the use of absorbent splitters and linings of considerable length of the type used for the attenuation of the noise of aero engines and propellers in test houses.

The outer case containing the public space and promenade is for the most part glass. It will, of course, pass low frequencies readily. It is important, consequently, to reduce the noise inside this space by means of absorbent ceilings, which will have a secondary and important advantage, that sounds will be attenuated passing through this space before they reach the openings into the main hall. The absorbents being used on the ceilings in these areas will be essentially low and mid-frequency types, consisting of unperforated panels, and perforated panels with glass silk in the air space between the panel and the ceiling construction. Probably perforated plasterboard will be used with special finishes; this is under development at the present time as an economical treatment. The entrances to the hall have naturally to be protected both against outdoor noise and the noise made in the public spaces by the public itself. Double doors, with an absorbent corridor between, will serve as a sound-lock, and the doors themselves are being treated to ensure that transmission is reduced along the edges of the main parts of the doors. Two or three different standards of insulation have been used for the door treatments according to the risk in the particular position concerned. One other important measure for insulation remains to be mentioned; there is included in the building a small theatre which is arranged so that its audience area comes underneath the main orchestra. This means that there is a considerable risk of noise from the orchestra and the organ reaching the audience of this small hall. It is hoped that this will be minimized or avoided by the following measures. The columns carrying the present hall are to be surrounded by an annular column carrying the future hall, and the inner and outer parts will be separated by a layer of glass silk properly protected. Also the outer annular column rests at the bottom upon a form of asbestos insulator known to give reasonable insulation under the considerable pressures involved here.



More Houses at Olynthus

By Professor R. E. Wycherley

SINCE MY brief account of the houses of Olynthus appeared in the JOURNAL (13 January 1947) Professor D. M. Robinson of the Johns Hopkins University has published another large volume (XII) of material from this important Greek site, mostly devoted to further careful descriptions of houses and streets. This new material does not call for a serious revision of my previous summary, but a short supplement may be of interest. In the first place, more is now revealed of the general street plan of Olynthus, which is seen to be a very interesting specimen of ancient Greek town-planning. The rectangular system, with long north-south avenues and numerous cross-streets, extended well out into the lower ground east of the two hills (to the west of these was an extensive cemetery and the river bed) though the cross streets were not actually carried down the east slope of the north hill and in the lower quarter took a slightly different line. There were some small deviations from the rectangular; for example 'Avenue E' curved round the contours of the hill on the north-east, and 'Avenue D' struck diagonally across the plan in the south-east, towards the harbour town. Apparently the 'gridiron' was not imposed on the site with the absolute rigidity found in some Hippodamian cities.

The houses published in Vol. XII include a number of particularly fine and well equipped specimens in the south-east part of the city, pleasantly situated on a slope facing south, sheltered from the north winds of Thrace. Some were very ingeniously adapted to the sloping site. It is clear that this was a comparatively wealthy quarter. Though conforming to the general gridiron plan, it was not so closely built up as the north hill. Several houses were larger than the Olynthian norm of about 60 ft. square. But the difference between this quarter and the north hill and the south hill was still not so great that one can speak of distinct 'wealthy', 'middle-class' and 'lower-class' quarters.

The south hill, too, where the old irregular part of the town lay, had two north-south avenues, roughly parallel, and a number of cross streets. Thus the new plan of the north hill may be considered a duplication in regular form of the old arrangement of the south hill. This was the essence of Greek town-planning—not to impose extravagantly new ideas but merely to create order out of disorder by the simplest and least revolutionary means. Towards the north end of the south hill is an area which the excavators call the 'civic centre', with a public building which may have been an assembly hall; but it is by no means clear that the agora, the heart of the city, has been identified.

I would tentatively suggest that the agora of the enlarged city is to be sought in the area left free from house blocks at the south-western end of the north hill, along the edge of which runs 'Avenue B', the main street of the new town, thus giving a normal relation between agora and main street. Professor Robinson prefers to call this place 'Area for Military Manoeuvers'—as indeed it may have been even if it was also agora—rejecting its claim to the title of agora on the ground that it has not its proper complement of public buildings. But we should remember that on comparable sites such as Miletus and Priene, although an area was reserved as agora from the beginning, the actual erection of great buildings was spread over long periods; and at Olynthus architectural development was cut short by Philip's destruction of the city in 348 B.C.

When we look at the new houses in detail, we get an even stronger impression than before of free and ingenious variety. There is no typical Olynthian house. There was a standard size and shape, but nothing like a standard interior arrangement. Take for instance the *pastas*, the long room extending east to west across the house, partly open to the court, which is so constant a feature that the Olynthian type has been called the *pastas* type after it. Usually it is present in a clearly recognizable form; but in several houses it is omitted, in many it is curtailed or broken up. Occasionally it is duplicated on another side of the court, and once at least it is carried continuously right across two houses, which clearly belonged to the same family. Some houses within the same area have twice as many rooms as others. It must have added considerably to the interest of daily intercourse when the houses of even one's immediate neighbours might have some complete surprises in store. This variety is all the more noteworthy when one remembers the severe and monotonous external form of the houses; most of them were, in fact, built in inseparable units of five (i.e., in half-blocks). All this is a symptom of the way in which the Greek, while strongly conscious of the obligation to take his proper place in the general pattern of city life, still contrived to assert a vigorous and refreshing individualism.

One or two detailed modifications of my previous account are necessary. The narrow alleys which bisected the blocks *were* occasionally used for communication, and several houses have entrances on them. The entrances in general are very variously contrived, and more houses have two than previously appeared. The court was always on the south side, with the main body of the house to the north of it, facing southwards; but it is not true that there were never any rooms south of the court. There were sometimes minor structures in this position, and the 'House of Many Colours', so-called from its elaborate decoration, has a 'summer living room' opening on the court through the colonnade, a pleasant shady room for use in the hottest days.

Plan of Olynthus drawn by Mr. T. E. Jones [*A*] of Bangor (after D. M. Robinson, *Olynthus*, XII, plates 271 and 272). Solid lines show houses excavated, dotted lines show streets and blocks which can be restored with reasonable certainty

Thermal Insulation in Building

By A. G. Sutton, M.A., M.Inst.F.

Part I

'O wall, O sweet and lovely wall.'
A Midsummer Night's Dream.

1. Introduction.

Thermal insulation is not just another aspect of building to be noted in passing and then forgotten; it is important and it pays. True, it is only comparatively recently that we have begun to realize its importance. The reasons for this are first, the departure from traditional forms of building construction, and second, the need to conserve fuel. The development of prefabrication methods and the increasing use of light sheeted structures have made structural insulation essential. Without insulation it would be difficult if not impossible to heat such buildings adequately and to attempt to do so would certainly be wasteful of fuel.

Thermal insulation and the heating of buildings are complementary. The heating engineer bases his calculations of the heat requirements of a building or room on the temperature to be maintained, the ventilation or number of air changes, and the rate of heat loss by transmission through the walls and other parts of the building structure. The extent to which the building itself has good thermal properties will, therefore, largely determine the size and cost of the heating plant that will be required and also the amount of fuel that will have to be consumed to maintain the desired temperature.

The factors affecting heat losses from a building—which the heating plant has to make good—are its size, shape, location, orientation, the materials of which it is built, and the extent to which it is air-tight. Obviously the size and location of the building will be governed by the purpose for which it is required. This too may influence its shape and orientation. It is worth while remembering, however, that for maximum economy in heating, the shape of a building should approach a cube as nearly as possible, so that its surface area may be small in relation to its volume.

These general aspects of good thermal building are mentioned so that insulation can be seen in its proper perspective. Considered by itself, insulation remains the most important single factor in reducing structural heat losses.* We must also keep an eye on infiltration losses, that is, the losses due to the replacement of warm air by cold; unless they are properly looked after, they may to a certain extent offset some of the benefits which the use of thermal insulation can provide.

* 'There is probably no single factor which may contribute to a greater saving of fuel used for heating buildings than the adequate use of insulation.'—*Fuel Efficiency Bulletin No.* 12 (Ref. 1).

2. The Importance of Insulation.

What is Insulation? Thermal insulation can best be described as a barrier to heat flow; it is not, of course, a complete barrier because all materials conduct heat to some extent, but some offer much more resistance than others. A sealed air space in a cavity wall, for example, helps to reduce the rate of heat flow through the wall.

Air, if only we could keep it still, would be the ideal insulator as it has a high resistance to heat flow by conduction. When air gets warm, however, it expands, and having become less dense in the process it rises to give place to cooler air. Convection currents are set up which to a certain extent promote heat transfer. If we divide an air space into a number of small cells we minimize the convection effect; we still get the advantage of the resistance of the air to heat flow by conduction, and the walls of the cells act as barriers to radiation. The best insulators, therefore, are those that contain a large number of small air cells while the materials of which they are made are at the same time poor conductors of heat.

Insulating Materials. There are several kinds of insulating material available commercially. Fibreboard and wood-wool slabs are used almost exclusively in building work; other materials have special uses in other fields, but are equally suitable for building insulation. Corkboard, for example, is used for cold storage and refrigeration; asbestos is used in industry at steam and higher temperatures and also for fire protection; slag wool and glass wool (known collectively as mineral wool) are multi-purpose insulators.

Insulating materials may be grouped conveniently in three forms: boards and slabs; quilts and foils; and loose fills.

Boards and slabs may be nailed or clipped in place or fixed with an adhesive, and are useful as non-loadbearing components of a structure. They can be used for the interior finished surface of walls and ceilings, and most of them can be painted, distempered or plastered as required.

Quilts or blankets, consisting of fibrous or granular materials enclosed between sheets of paper or cloth can be laid below floors or over ceiling joists, or fixed behind wall panelling.

Loose fill materials, as their name implies, can be spread or poured over ceilings between the joists (Fig. 1), or used to fill the space between enclosing walls.

Aluminium foil, whose insulating property depends on its power to reflect heat, is used like a quilt or blanket but always in conjunction with an air space. If both sides of a sheet of foil are in contact with any

Fig. 1: Attic insulation; a loose fill material above the ceiling between joists

solid material heat will pass through it by conduction and it will have no value at all as insulation.

Certain light-weight building blocks and concretes also have good insulating properties, and they can usefully be employed when it is not convenient to use separate materials for loadbearing and insulating purposes.

Why is insulation important? Lightly-constructed buildings without insulation would be very chilly and uncomfortable to live in, and it would be very wasteful of fuel to attempt to heat them. But even the traditional pre-war house provides a rather poor standard of comfort. In fact, it has been said that the ratio of comfort obtained in the home in this country to the fuel consumed is almost the lowest in the world (Ref. 2(*a*) at end of article). The habitable part of many houses in winter is within a semi-circle of about 6 ft. radius in front of the living-room fire. Insulation and the use of modern heating appliances together provide the means of getting greater comfort and better distribution of warmth for the same or even less expenditure on fuel.

Structural insulation is usually incorporated in the building itself—it forms part of the building structure; that is why it is a subject of particular importance to architects. Insulation is the basis of good thermal building and must be considered right from the start. Once a building is up, it may be both difficult and expensive to insulate it properly; the most we can do to existing buildings is to insulate the ceiling or roof, as the case may be. Insulation of the walls would normally be a major and costly operation involving redecoration afterwards.

How much does insulation cost? In new buildings the cost of insulation may be negligible. For walls, we can use porous materials instead of dense concrete or brick at little if any extra cost (Ref. 2 (*b*)). The top floor ceiling of a house can be insulated for about £5 to £12, depending on the material chosen (Ref. 3). If fibreboard is used instead of plasterboard for the ceiling, the extra cost is only about 6d. to 9d. a sq. yd., or about £2 per house.

The cost of insulating the corrugated asbestos cement roof of a new factory may frequently be completely offset by the reduced cost of the heating plant that will be required; there will then be no increase

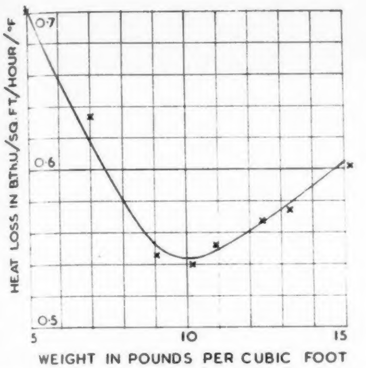


Fig. 2: Variation in heat loss through a material with density of packing

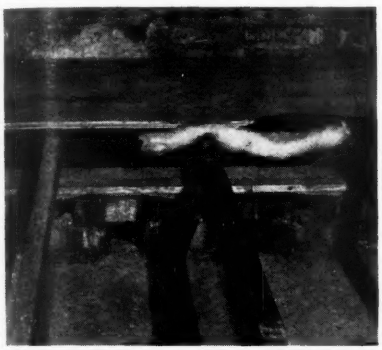


Fig. 3: Insulating quilt laid over joists below a floor

in the initial capital cost of the factory while the annual cost of heating it will be much reduced. There are many cases where insulation can profitably be added to an existing building; the cost will often be recovered in three or four years by the saving of expenditure on fuel.

Is it worth it? In terms of fuel-saving alone the use of insulation pays handsomely. It also has other advantages which are not easy to assess in terms of money. A building or room with an insulating lining warms up quickly and the absence of cold surrounding surfaces adds to the comfort of occupants. In industry, this has sometimes had the effect of increasing production. Insulation helps to prevent condensation and pattern staining, and eliminates down-draughts from cold ceiling and wall surfaces. In certain cases it increases fire resistance and affords protection from the sun in summer. On the other hand some materials, e.g. those with an envelope or backing of paper, may in certain locations increase fire risk by promoting surface flame spread unless specially treated before use. Expert advice should be obtained when there is a special risk of fire.

3. Structural Heat Losses.

In order that we may compare the relative insulating values of different materials, or assess whether a structure is thermally good or not, it is necessary to have some

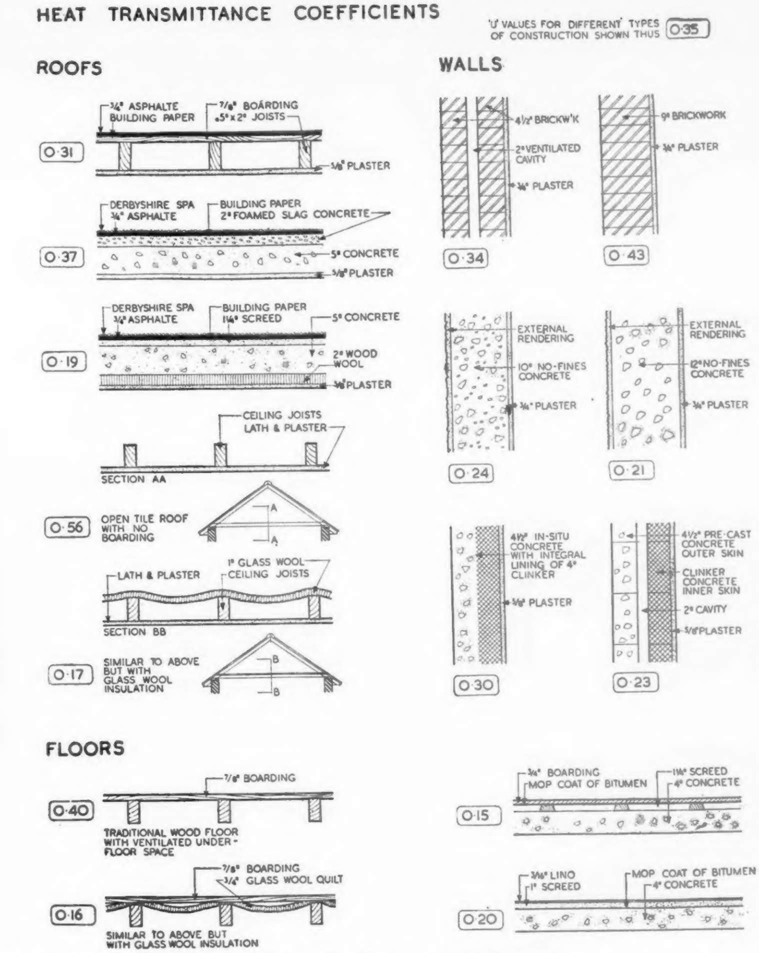


Fig. 4: Heat transmittance coefficients of typical structural elements

knowledge of the nature of heat transmission. The rate of heat loss through the walls and roof of a building depends on their construction, their area, and the difference in the temperature of the air on either side of them. If we know the heat transmittance coefficient of a particular wall structure, for example, we can calculate the rate of heat loss through the wall.

The heat transmittance coefficient, or 'U value' of a structure can be determined if the thermal conductivities and thicknesses of its several components are known.

Thermal Conductivity. The thermal conductivity of a material or substance is determined by measuring the quantity of heat which passes per unit of time through unit area of a slab of indefinite extent and of unit thickness when unit difference of temperature is established between its faces (Ref. 4). Thermal conductivity is denoted by the small letter '*k*' and is usually measured in British Thermal Units* per square foot per hour for 1 inch thickness and 1 degree F. temperature difference. This is often abbreviated B.Th.U./sq. ft./hr./deg. F./in. It is not, however, a question of B.Th.Us *per* inch thick, for if we double the thickness of a material, the heat flow through it will be halved. To be correct, therefore, this expression should be written B.Th.U.inch/ft.^{2}hr.°F. It is understood that this will be adopted in future British Standards dealing with thermal insulating materials.

The thermal conductivity of a material varies with its density and also with the temperature. In buildings we are only concerned with quite a small temperature range —say from about 30 deg. F. to 80 deg. F.— and the variation in conductivity with temperature over this range would be negligible. We must assume that figures of thermal conductivity quoted for structural insulating materials relate to this range of temperatures.

Variation of conductivity with density. Variation with density may be important when considering the thermal conductivity of a loose fill material.

The graph (Fig. 2) illustrates the change

* A British Thermal Unit or B.Th.U. is the amount of heat required to raise the temperature of one pound of water from 63 deg. F. to 64 deg. F.

in heat loss through a sample of slag wool with density of packing (Ref. 5).* In this particular case, the optimum density from the point of view of insulation is 10 lb. per cubic foot. If the slag wool is teased out to occupy as much space as possible, we get convection currents in the relatively large air spaces between the fibres. This assists heat transfer. On the other hand, if we pack the material tightly the transfer of heat is helped by the closer contact between the fibres of slag wool and by the reduced air content of the insulation. We get the best insulation—minimum heat flow—when we trap as much air in the material as possible without allowing convection currents to develop.

When placed in vertical cavities, loose fill materials of this type tend to settle with the passage of time, particularly if subjected to vibration; the material at the bottom gets compressed whereas the top of the cavity is left with no insulation at all. It is better in such cases to use materials in quilted form. Slag wool, glass wool and eel grass are examples of materials which are made up into blankets or quilts enclosed in kraft paper or cloth.

Before making use of a figure for the thermal conductivity of a material it may be advisable to verify the authority on which it is quoted, and also the conditions under which the material was tested. It is significant that in the certificates issued by the National Physical Laboratory giving the results of thermal conductivity tests, the density of the sample and the temperature range of the tests are always quoted.

Thermal Transmittance. The measurement of the thermal conductivity of a slab of material takes into account the temperature of its opposite faces. When we come to consider the heat flow through a building structure, however, we are not concerned with its inner and outer surface temperatures but with the temperatures of the air on either side.

Thermal transmittance—symbol, capital 'U'—is the number of B.Th.Us transmitted per hour through a square foot of the construction when a temperature difference of 1 deg. F. exists between the air on the two sides of the construction. This may be abbreviated B.Th.U./ft.^{2} hr. °F.

Note that we are now dealing with a complete structure, such as a cavity brick wall with rendering outside and plaster inside, or a roof of corrugated sheeting with a wallboard lining and an air space in between. Each component of the structure offers a resistance to heat flow in proportion to its thickness and inversely in proportion to its thermal conductivity. Thus the resistance of a material of thickness L and conductivity k is L/k.

Surface Resistance. The inner and outer surfaces of a structure each offer resistance to the passage of heat. Consider for example the wall of a warmed room. The rate at which it can absorb heat from the room depends on the inner surface resistance of the wall. Similarly, the rate at which the outer surface can dissipate the heat it receives to the surroundings depends on the outer surface resistance. For our purpose we can take the surface resistances to be constants, depending on the nature of the surfaces.

The surface resistances commonly used in heat transmission calculations are shown in Table I.

TABLE I—SURFACE RESISTANCES

Roofs:	
External surface, corrugated	0.20
External surface, plane	0.25
Internal surface, corrugated	0.48
Internal surface, plane	0.60
Walls:	
External surface, corrugated	0.24
External surface, plane	0.30
Internal surface, corrugated	0.56
Internal surface, plane	0.70

Note that for plane surfaces, the internal and external surface resistances for walls conveniently add to 1; for roofs they are together equal to 0.85. The word 'plane' is used here in its geometrical sense meaning a flat surface as opposed to a corrugated one. The figures apply, irrespective of the colour or texture of the surface, except in the case of bright metallic foil.

Air Spaces. The provision of a closed or unventilated air space within a structure adds to its resistance, mainly on account of the surface resistance of its boundaries. The resistance of an air space bounded by the plane surface of normal building materials, provided it is at least ¾ in. in width, is normally taken as 1.0. This figure includes the surface resistances of the boundary walls of the air space.

Air to Air Resistance of a Structure. We are now in a position to calculate the total air-to-air resistance of a structure. This is simply the sum of the resistances of its components, including any air spaces, plus the internal and external surface resistances. The equation for this may be written:

$$R = R_{si} + R_{so} + \frac{L_1}{k_1} + \frac{L_2}{k_2} + \cdots + R_a$$

where R is the overall air-to-air resistance of the structure, R_{si} and R_{so} are the internal and external surface resistances, L_1/k_1 is the resistance of the first component, of thickness L_1 and thermal conductivity k_1, L_2/k_2 is the resistance of the second component, the dots represent any other components, and R_a is the resistance of any air space within the structure.

Finally, the thermal transmittance coefficient, U, is the reciprocal of the total resistance; or $U = 1/R$.

TABLE II. THE 11 in. CAVITY BRICK WALL

	Thickness of material	Conductivity	Resistance
	L	k	L/k
External surface			0.30
4½ in. brick	4½ in.	8.0	4½/8 = 0.56
2 in. air space			1.00
4½ in. brick	4½ in.	8.0	4½/8 = 0.56
¾ in. plaster	¾ in.	4.0	(¾)/4 = 0.19
Internal surface			0.70
		Total Resistance	3.31

$U = 1/R = 1/3.31 = 0.30$

Example. Table II is an example showing the method of calculating the thermal transmittance of an 11-inch cavity brick wall, plastered on the inside (Ref. 1). The thermal conductivity of common brick is about 8.0 and that of plaster about 4.0.

Note that the air space contributes a resistance of 1, or nearly a third of the total resistance in this case. A 9 in. solid wall, plastered internally, has the same components except for the air space. Its total resistance will therefore be 2.31, so its thermal transmittance is 0.43 (= 1/2.31).

4. Standards of Insulation for House Construction.

It is clear, by direct comparison of U values—0.43 and 0.30—that, for the same internal and external conditions a 9 in. solid wall allows nearly 50 per cent more heat to pass through it than does an 11 in. cavity wall. By modern standards, however, although it is much better thermally than the solid wall, the 11 in. cavity wall is not considered good. A thermal transmittance of 0.30 is still too high. It can, of course, be reduced by adding a layer of insulation; but, as insulation costs money, the question is how much insulation can we afford, bearing in mind the reduced fuel consumption and heating costs, and the increased comfort to the occupants of the building that will result.

The Balance of Insulation Cost with Fuel Saving. This problem is dealt with in Post-War Building Studies No. 19, usually referred to as the Egerton Report (Ref. 6). Chapter IV of the Egerton Report deals with the insulation of dwellings, and this is what it says about the importance of insulation:

'The coal consumed annually in the heating of dwellings and small commercial premises in Great Britain is approximately 63 million tons, and its value would equal the capital cost of 200,000 to 300,000 houses. The utmost importance should therefore be attached to the conservation of heat in the building of houses.

'Improvements in the insulation of buildings will in general reduce both the fuel bill of the occupant, and the amount of

* The thermal conductivity of slag wool is generally taken as 0·30. This graph, taken from the Dictionary of Applied Physics which was published in 1922, is used here purely to illustrate that heat loss through a material—i.e., its thermal conductivity—does vary with its density.

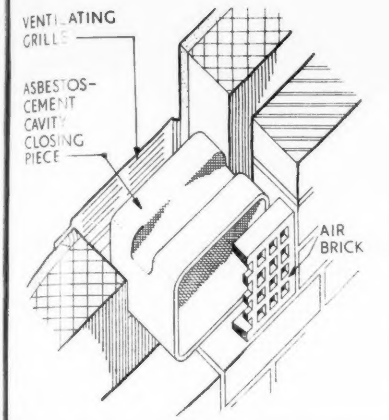


Fig. 5: A cavity closing piece avoids ventilating the cavity

coal which has to be mined. A balance must be arrived at as to the expenditure on insulation, additional to the normal cost of the building, which can justifiably be incurred on account of the substantial saving in the heating cost. No absolute criterion can be laid down, for the saving in cost of heating depends upon fuel prices and on the efficiency with which the fuel is used. The higher the thermal efficiency and the less expensive the fuel, the less will be the saving attainable by means of insulation.'

The Report then proceeds to examine the annual heat losses from a typical small house of pre-war construction. The expenditure on insulation which is considered justifiable is based on half the saving in heating costs. Tables are given for various methods of construction of external walls, ground floors and roofs showing their U values and the allowable increase in initial cost per square foot which can be justified in order to attain them.

Egerton Standards. The standards of insulation for dwellings recommended in the Report are set out as follows:

'... it would be an economy to require, as maxima, the following values of the heat transmittance coefficient for alternative forms of construction, where such values can generally be easily obtained; and for normal forms of construction where the heating methods installed are controllable. Still lower values are to be preferred when they can be obtained economically.

External walls: (*a*) for any part of the house, U not to exceed 0.20 B.Th.U./sq. ft./hr./deg.F. (*b*) for the walls of the warmed living room, U not to exceed 0.15 B.Th.U./sq.ft./hr./deg.F. Ground floor, U not to exceed 0.15 B.Th.U./sq. ft./hr./deg. F. Roof and top-floor ceiling, U not to exceed 0.20 B.Th.U./sq. ft./hr./deg. F.

In houses where apparatus may be installed which is not readily controllable, there may not be the same economic justification for considerable expenditure on insulation, although there will always be some saving of fuel. In such cases the following maximum values of the heat transmittance coefficient might be appropriate:

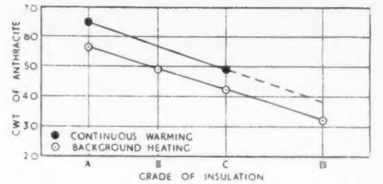


Fig. 6: Fuel consumption for six winter months with different grades of insulation: B.R.S. Experimental Houses at Garston (unoccupied period)

External walls of living room, U not to exceed 0.20 B.Th.U./sq. ft./hr./deg. F. Ground floor, U not to exceed 0.15 B.Th.U./sq. ft./hr./deg. F. Roof and top-floor ceiling, U not to exceed 0.30 B.Th.U./sq. ft./hr./deg. F.'

Other values have been suggested by various authorities at different times. A good compromise, and indeed probably the best figure to adopt in present circumstances, would be a maximum of '0.20 all round,' i.e., for walls, ground floor, and roof and top-floor ceiling—aiming at a lower figure when it can be obtained economically.

5. Methods of Construction to Attain These Standards.

Walls. Remembering that the thermal transmittance of an 11 in. unventilated cavity wall is 0.30, how are we to attain these standards in practice? One way would be to add a layer of insulation to the inner leaf of the wall before plastering; wood-wool slabs or fibreboard on battens (giving an additional air space) would be suitable materials, but this would increase the cost of the wall. The cavity itself, besides helping to resist heat flow, is required to give protection from moisture penetration; it would therefore be unwise to fill it up with loose insulating material. Acting as a bridge for the transfer of moisture from the outer to the inner leaf it would also lose its efficiency as an insulator when it became wet.

We can retain the advantages of the traditional cavity brick wall and meet the required standard of thermal transmittance by using light-weight building blocks for the inner leaf at little, if any, extra cost (Ref. 2(*b*)). Some examples of cavity wall construction with 4½ in. brick for the outer leaf in each case are shown in Table III.

TABLE III—THERMAL TRANSMITTANCE OF CAVITY WALLS
(2 in. unventilated air space)

Outer leaf	*Inner leaf*	*U*
4½ in. brick	4½ in brick	0.30
4½ in. brick	4 in. clinker block	0.23
4½ in. brick	4 in. foamed slag	0.20
4½ in. brick	2 in. wood-wool slabs	0.17

These figures are typical for the materials shown. The actual value in the case of clinker blocks and foamed slag blocks will depend on the mix, as also will their structural strength. Actually, the strength of a cavity brick wall is normally very much greater than is necessary for house building, and the alternatives shown will be found quite adequate in this respect. Wood-wool slabs, however, should not be called upon to carry any load; they are included in the Table for purposes of comparison but their use presupposes sufficient strength


Fig. 7: Spooner House, Hull; timber frame. Walls: ground floor; 4½ in. brick outer leaf, 1½ in. air space, bitumen felt, 1 in. glass wool, kraft paper, 2 in. air space, ⅜ in. plasterboard, skim coat of plaster, all giving U=0.14. Walls: first floor; 18 s.w.g. galvd. iron, ½ in. fibreboard, 2½ in. air space, ⅜ in. plasterboard, skim coat, all giving U=0.27. Roof: low pitch (1 to 9 slope) timber trusses, at 4 ft. centres, asbestos cement sheeting on steel purlins, ceiling of ⅜ in. insulating board, with 1 in. glass wool lying on top, all giving U=0.19. (Alternative: as above, but with 33 s.w.g. copper sheet on ½ in. t. and g. timber boarding, ceiling as above, all giving U=0.16.) Ground floor: r.c. raft 6 in. thick with ⅝ in. thick pitch-mastic on floor, giving U=0.2


Fig. 8: Part of the wall of a Spooner House showing glass wool insulation behind building paper

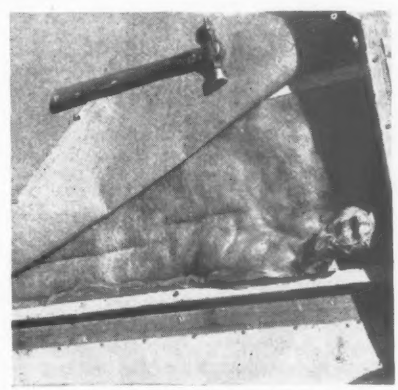


Fig. 9: Glass wool insulation above fibreboard ceiling (Spooner House)

in the outer leaf or the use of a framed construction if necessary.

Floors. Let us now consider the ground floor of a house. The thermal transmittance of a ventilated wood floor on joists with bare boards is 0.30. If covered with parquet, linoleum or rubber, it is 0.25 (Ref. 7). These figures are with air bricks on one side only. If there are air bricks on more than one side, giving increased ventilation below the floor, the figures become 0.40 for bare boards, and 0.35 for boards covered with linoleum or rubber.

On the other hand, the U value of a solid concrete floor in contact with earth or hardcore is 0.20, and with a wood block floor on concrete it is 0.15 (Ref. 7). The solid concrete floor is therefore preferable to the suspended timber floor. Although it may *feel* colder, the heat loss through it is less, and it may in fact prove to be cheaper if the site is reasonably level.

The heat transmission through a suspended floor can be reduced to the required figure by applying insulation between the boards and the joists or below the joists. A glass wool quilt is shown in Fig. 3 being applied over the joists before laying the floor. Other types of quilt, foil or insulating board can equally well be used. The space, if any, between the insulation and the floor itself should be sealed from the ventilated space below.

Roofs. So far as heat losses are concerned, the roof and top floor ceiling are considered together. After heat has passed through the ceiling it is lost to the occupied part of the house. For this reason it is usual to insulate the ceiling. This is much easier than insulating the sloping roof and the amount of material required is less.

The thermal transmittance of a traditional pitched roof—tiles on battens, felted, with plaster or plasterboard ceiling—is 0.43. This can be reduced quite simply to 0.2 by adding a layer of insulation above the ceiling. Loose fill material can be spread or poured between the joists. Quilts or blankets or aluminium foil can also be used, and if laid over the top of the joists they form an air space which contributes further resistance to heat flow if it is sealed at the ends.

Some examples of various types of construction for walls, floors and roofs with their U values are given in Fig. 4.

6. Fuel Saving Attainable by Insulation of Houses.

Design alone will not automatically produce savings in fuel consumption, although good insulation will make fuel saving possible. If the temperature of a room is adjusted by opening doors and windows instead of by reducing the heat input, insulation may have no effect at all on the amount of fuel used for heating. The insulation cannot be blamed for this. But we must remember that the savings it produces by reduced heat transfer through the walls and ceiling may be lost sight of if the ventilation losses due to replacement of warm air by cold are excessive.

The best results will be obtained when ventilation is kept down to a minimum, and when the heating appliance is controlled intelligently. This you may say is not the concern of the architect—he cannot accept responsibility for the behaviour of the tenant. That is true, but it explains why results may not always be up to expectations.

Supervision of Construction is as important as Design. There is another point about performance in relation to design, however, which is, or should be, the responsibility of the architect; that is to see that the insulation has been erected properly and will do its job. Insulation is a barrier to heat flow, but to be effective there must be no gaps in the barrier. Take for example the cavity wall: a sealed air space or cavity offers resistance to heat flow and so adds to the insulation value of the wall. If the cavity is ventilated, however, and particularly if the wall is exposed, we approach atmospheric conditions in the middle of the wall and lose much of the thermal resistance value of the outer leaf.

Ventilation of a room or under-floor space can be provided without ventilating the cavity. One method which has proved successful is shown in Fig. 5. An asbestos-cement closing piece of special design is used to bridge the cavity between the air brick and the ventilating grille. The sloping part at the top should be lined up with the cavity so that any mortar droppings may be deflected and moisture will drain away.

B.R.S. Experimental Houses at Garston. Dufton's report (Ref. 8) on experiments carried out in six houses at the Building Research Station at Garston shows the effect on fuel consumption of different grades of insulation where the heating plant in each case was controlled to provide similar conditions in the living-room.

The houses were designed to provide the four distinct grades of insulation shown in Table IV. Grade A represents the ordinary pre-war house and Grade C the Egerton Standard. B is intermediate between A and C while D is still better than the Egerton Standard.

Fig. 10: A 'Brick-Modern' House at Slough. Development of the traditional cavity brick wall using prefabrication methods. Walls: 4½ in. brick outer leaf, 2 in. air space, 3 in. breeze blocks, ¼ in. plaster, giving U=0.26. (Alternative: 4½ in. brick outer leaf, 2 in. air space, but with 3 in. foamed slag, giving U=0.22. Second alternative: 4½ in. brick outer leaf, 2 in. air space, but with 4 in. foamed slag, giving U=0.19.) Roof: pitched, with steel trusses and purlins, asbestos cement sheeting, ceiling of ⅜ in. plasterboard and 1 in. glass wool, giving U=0.17. Ground floor: r.c. raft 6 in. thick, with ⅝ in. thick pitch-mastic on floor, giving U=0.2

In two of the houses, the living-room was heated continuously by the solid-fuel boiler, no other heat source being provided. In the other four houses, one of each grade of insulation, the boiler provided background heating and topping up was by electric radiator. The fuel consumptions for the period 1 October to 31 March are plotted in Fig. 6*, illustrating the progressive reduction as the grade of insulation rises from A to D. The corresponding figures are shown in Table V.

In the four houses where background heating only was provided, the electricity consumption for topping up was about 1,800 kWh in each case.†

* 'The grades have been set out so as to give a straight-line graph for background heating. This is convenient as it enables interpolation to be made for grade B, and extrapolation for Grade D, on the graph for continuous warming.'

† 'The electricity required for topping up appears to be virtually independent of the grade of insulation provided and the amount is substantially the same in each house—about 1,800 kWh for each living-room for the six winter months. The reason for this is believed to be that the requirement depends more upon the intensity of radiation provided by the fire than upon the increase in the rate of heat loss due to the increased warming of the room.'

TABLE IV—U VALUES OF B.R.S. EXPERIMENTAL HOUSES, GARSTON

	Grades			
	A	B	C	D
External walls	0.30	0.25	0.20	0.15
,, ,, living room	0.30	0.20	0.15	0.10
Windows	1.0	1.0	1.0	0.5
,, living room	1.0	1.0	0.5	0.5
Ground floor	0.35	0.20	0.15	0.10
Roof and top-floor ceiling	0.56	0.30	0.20	0.15

TABLE V—FUEL CONSUMPTION IN B.R.S. EXPERIMENTAL HOUSES OCTOBER TO MARCH—UNOCCUPIED PERIOD

	Grade A	Grade B	Grade C	Grade D
Continuous warming ..	64.7 cwt.		49.4 cwt.	
Background heating ..	56.8 cwt.	49.6 cwt.	42.6 cwt.	32.4 cwt.

TABLE VI—FUEL SAVING DUE TO INSULATION

Grade of Insulation	Saving of fuel	Monetary value at £4 4s. per ton
		£ s. d.
B	7.2 cwt.	1 10 3
C	14.2 cwt.	3 0 6
D	24.4 cwt.	5 1 8

The fuel savings due to insulation compared with the pre-war standard (Grade A) are shown in Table VI.

The saving found for grade C from experiments in the two houses in which the living-rooms were kept comfortably warmed amounted to 15.3 cwt., valued at £3 4s. 3d.

Dufton's paper on these experiments ends with the following conclusions:

'The experiments which have been carried out in six small houses confirm the view of the Egerton Committee that an expenditure on insulation can justifiably be incurred, additional to the normal cost of building, on account of the substantial saving in the heating cost. They confirm that, if the additional initial cost does not exceed £60 for a small house, the maximum values of thermal conductance [*sic*] put forward by the Committee are reasonable, and that still lower values are to be preferred where they can be obtained economically.

'The *dictum* of the Committee, that those responsible for the choice of methods of heating of new houses need to make a careful study of the relative costs of the various systems available in any district, is lent added emphasis by the investigation into the advantage of eliminating topping-up by an electric fire and of warming the living room solely by the central heating installation.

'The experiments show that it is practicable to heat a house with an economy of fuel even greater than is apparent in the Egerton Report. It is hoped that this demonstration will lead to increased economy and efficiency for the individual user and to a more economical utilisation of the national fuel resources.'

The first of the three paragraphs quoted above points out the value of insulation on a financial basis. It does not mean, however, that it may cost anything up to £60 to do the job properly. If that were the case there would be little likelihood of insulation being used at present when architects are looking for ways and means of reducing the cost of house building.

7. Insulation in Modern Low-cost Housing.

Four examples have been chosen to illustrate the use in practice of some of the methods of insulation that have been described above.

The Spooner House shown in Fig. 7 has a timber frame, insulated cavity walls, and low-pitched asbestos-cement roof with insulated ceiling. The outer leaf of the walls is of brick on the ground floor and galvanized sheeting on the first floor.

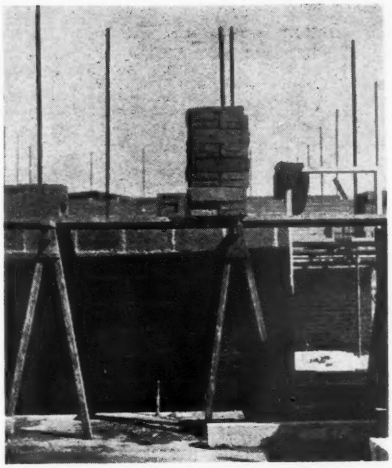


Fig. 11: Lightweight building blocks as inner leaf of walls ('Brick-Modern' House)

Fig. 8 is a photograph of the ground floor wall taken from inside the house before the plasterboard was applied. The glass wool insulation can be seen behind the building paper. The other side of the insulation is backed with bitumen felt for moisture protection. In Fig. 9 the building paper has been laid back to show the glass wool lying on the fibreboard ceiling.

The 'Brick-Modern' House, Fig. 10, is a development of the traditional cavity brick wall construction using prefabrication methods. The outer leaf of the walls is of 4½ in. brick, and the inner leaf of light-weight building blocks, plastered. Like the Spooner House, it has a corrugated asbestos-cement sheeted roof with insulated ceiling.

The light-weight block construction of the inner leaf of the walls is shown in Fig. 11.

Most readers will be familiar with the Airey House. The example shown in Fig. 12 has a frame of concrete posts into which are fitted the precast concrete slabs forming the outer leaf of the walls. The inner leaf of the walls is of clinker blocks, and the air space or cavity is divided into two with paper-backed aluminium foil insulation. Aluminium foil is also used for the insulation of the top floor ceiling.

Fig. 13 is a photograph taken before completion of the inner leaf showing the aluminium foil in place. Each section of foil is cut wider than the distance between its supports so that it will stand away from the clinker blocks and thus form an air space.

Incidentally, as an example of light construction with added insulation, this is a good illustration of why supervision as well as design is important if the desired results are to be obtained. When the outer leaf of a wall is sheeted or of light construction, it is important to see that the joints are properly air-tight. If there are gaps or cracks between adjacent sheets or blocks in the outer wall, we shall get air leakage through them, particularly when it is windy. In

Fig. 12: Airey Rural House, Cheshunt (concrete posts). Walls: outer leaf precast concrete slabs, 1 5/16 in. mean thickness, 4¾ in. air space, kraft paper with aluminium foil on side facing inwards, 3 in. clinker blocks, ¼ in. plaster, all giving U=0.19. Roof: traditional pitched roof (tiles on battens, felted but no boards, paper backed aluminium foil over ceiling joists, plasterboard ceiling, all giving U=0.19. Ground floor: 2 in. clinker concrete over r.c. raft, with timber battens projecting ¼ in. (to form air space), ⅞ in. t. and g. boarding, all giving U=0.15

other words, we shall have a well-ventilated cavity. If the inner leaf of the wall is also of light-weight porous blocks, they should be properly plastered on the inside, otherwise air will leak through them too, with resulting draughts and high heat losses.

Most insulating materials are porous and allow air to leak through them if the structure itself is not air-tight. Paper reinforced aluminium foil, as used here, will not allow air to pass through it, but unless it is fixed in place so that air cannot get round it its effect as insulation will be very much reduced.

Another type of construction is represented by the No-Fines Concrete House. This is an example of using a material for building which combines structural strength and the necessary thermal properties without using any additional insulation. No-fines concrete, as the name implies, contains no sand, and is usually made with a light-weight aggregate such as foamed slag or clinker.

Some of the Ministry of Works demonstration houses built at Northolt in 1944 were of this type. Typical thermal transmittance figures were (Ref. 9):

No-fines concrete house (Block 1), 12 in. walls with clinker aggregate—U=0.23.

Foamed slag house (Block 2), 8 in. walls—U=0.16.

Expanded clay house (Block 6), 8 in. walls —U=0.16−0.20.

Characteristic of no-fines concrete is its rough and pitted surface which provides an excellent key for rendering (Fig. 14).

8. The Behaviour of Different Types of Construction.

The principle of insulation is the same whatever type of building we may be concerned with—houses, flats, hospitals, offices, or commercial or factory buildings. Insulation is important if they are to be heated economically, and if they are to be comfortable to live or work in.

The four houses described above have illustrated various methods of construction by which the Egerton standards of insula-

tion can be met. A wall of solid brick or dense concrete, if made thick enough, would also, theoretically, serve the same purpose. For a thermal transmittance of 0.20, however, it would need to be about 30 in. thick.

At one end of the scale, therefore, we have thin sheet materials which require added insulation, and, at the other end of the scale, if we take the extreme case, thick solid construction. Both, in theory, could have the same low heat transmittance figure. In practice, however, they would behave differently on account of their different thermal capacities.

The Advantage of Linings with Low Thermal Capacity. The thermal capacity of a material or structure is a measure of its heat-absorbing property. A heavy dense material takes time to heat up and absorbs a good deal of heat in the process. This also applies to a building of solid construction. Once it has reached a steady temperature it will not respond readily to day-to-day temperature variations. On the other hand, a light structure will heat up rapidly without absorbing so much heat; it will also cool down quickly when the heating is turned off.

These differences in behaviour are not very noticeable when heating is continuous but they are important when intermittent heating is used. The heat put into a building as it warms up will be lost every time it is allowed to cool down. Moreover, if the heating cycle is rapid the building may never get a chance to warm up properly.

It is often an advantage to line the walls of a room with a material of low thermal capacity. A lining of fibreboard, for example, will heat up quickly, and its surface will attain a temperature within a few degrees of that of the air in the room. Now our feeling of comfort is affected by the temperature of surrounding surfaces as well as by the temperature of the air in the room. If the wall surfaces are warm we lose less heat to them by radiation from our bodies and we therefore feel warmer than we should with cold surrounding surfaces. The result may be that less heating will be required, and the heating-up period will be reduced; both these factors produce a saving in fuel, in addition to the saving due to reduced thermal transmittance.

A further advantage of low thermal capacity linings is that they tend to prevent condensation. Condensation occurs when moisture-laden air comes into contact with surfaces at a temperature below the dew point of the air. The higher surface temperatures of walls lined with insulation of low thermal capacity therefore help to prevent condensation.

Windows. And now a word about windows. We all know the cold down-draught we get from windows. That is one of the reasons why radiators are frequently placed beneath them in an attempt to counteract the draught. The thermal transmittance of a single sheet of glass is around 1.0; in other words, it is about five times as bad as a good wall (Egerton 0.20). Heat losses through large windows may therefore be considerable; on the other hand we get the advantage of a gain of heat from the sun through windows facing south, south-east or south-west.

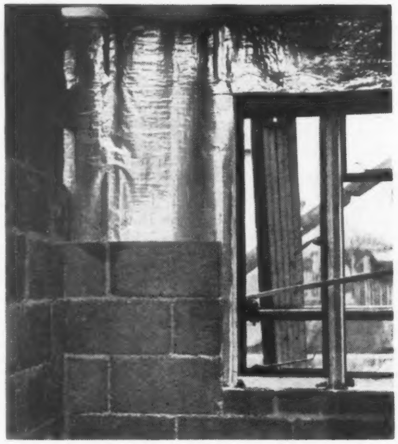


Fig. 13: Aluminium foil insulation behind clinker blocks (Airey House)

Fig. 14: No-fines concrete house at Manchester showing end wall before rendering

Double windows reduce the thermal transmittance to about 0.6, or nearly 50 per cent. They help to prevent the down-draught and reduce the likelihood of condensation such as occurs on window panes in cold weather. The air space between the glass panes acts as insulation.

Double windows can be provided in two ways: by storm windows—i.e., by adding a separate inner window frame—or by double glazing. Double glazing units are being developed by glass manufacturers in this country, but they have not yet been produced on any large scale. The main difficulty is that the air space has to be sealed in order to prevent dirt and moisture collecting inside. Quite a small crack will allow the unit to breathe with changes in atmospheric pressure and temperature. Air going in carries dirt and moisture with it, and they remain there when the air is expelled again. Storm windows can be opened independently for periodic cleaning.

Further investigation of the benefits and economics of double glazing is required; in the meantime, it has been suggested (Ref. 10) that in this country there is not a great difference between the amounts of fuel required for heating rooms with large or small (single) windows, but that small windows are to be preferred for east and west walls.

9. Summary of the Problem of Good Thermal Building as Applied to House Construction.

Heat losses from a warmed building occur by transmission through the building structure itself, and by the escape of warm air and its replacement by cold air from outside.

The transmission losses through the walls, floor and roof can be kept down to a minimum by adequate insulation. That is a matter both of design and of supervision during erection to see that the insulation is properly placed.

The operation of the heating plant and the opening of doors and windows are not under the architect's control. Nevertheless, the architect can help to reduce excessive ventilation losses by seeing that the building is as air-tight as possible. Cracks between floorboards and at the edges between the floor and the wall skirting; ill-fitting doors, windows and access hatch to the loft; gaps between the walls and roof at the eaves and gable ends and along the ridge; all these allow the infiltration of cold air, causing draughts and excessive air change, resulting in discomfort to the occupants and waste of fuel.

The main points requiring consideration in the design of a house may be summarized as follows :

1. First of all there is its shape. It is as well to remember that something approximating to a cube will give the largest volume with the smallest area of walls and roof.

2. The ground floor: a solid floor is preferable to a suspended timber floor, and may actually be cheaper if the site is reasonably level. With a finish of wood blocks, or boards supported on battens to provide an air space, a U value of 0.15 is attained.

3. The walls: thin sheet materials in conjunction with a framed structure require additional insulation. Joints between sheets must be properly sealed to prevent infiltration of cold air, and the insulation must be properly fixed to prevent it being bypassed. A more solid construction is preferable—e.g., a solid wall of no-fines concrete with light-weight aggregate, rendered outside and plastered inside, or the traditional cavity construction with unventilated cavity using light-weight blocks for the inner leaf. When using porous materials remember the possibility of air leakage and the need for adequate rendering outside.

4. The windows: the main essential is to see that windows and window frames fit properly; this also applies to doors. In both cases weather-stripping or draught excluders can be very useful. The use of double glazing or storm windows should be

borne in mind in individual cases as circumstances permit.

5. The roof: the roof and top floor ceiling are considered together so far as heat losses are concerned; the roof space is not a useful part of the house except for storage purposes. The ceiling should preferably be of fibreboard or similar insulation such as wood-wool slabs, plastered. Additional insulation can be provided by loose fill material between the joists above the ceiling or by a layer of quilt or foil above the joists.

The value of the attic as an air space in resisting heat flow depends on how airtight it is, quite apart from the insulation of the ceiling. Sometimes quite wide gaps are found at the eaves, which are difficult of access after the house has been built. Felt below the tiles or slates helps to keep the draught out; a felted roof should be considered a minimum requirement.

10. Lagging.

It is always advisable to lag the cold water cistern and pipes in the roof space for frost protection. It is important to do so when the attic has been insulated. The ceiling immediately below the cistern may be left without insulation to allow warmth from below to reach it.

The point most vulnerable to frost attack is the bend in the cold-water supply pipe under the eaves, and it is always awkward to reach to thaw it out. This trouble can best be avoided by installing the cold water feed pipe on an inside instead of an outside wall.

The hot water cylinder or tank, wherever it is placed in a house, should always be lagged, and so should the primary flow and return pipes between the boiler and the tank. The cost of lagging can be justified by the saving of fuel that will result. The heat loss from a 30-gallon hot water storage tank or cylinder in a cupboard amounts, in a week, to 265,000 B.Th.U. The corresponding weekly fuel loss, with a solid fuel fired boiler, is half a hundredweight of coal or coke. This is actually more than the amount of heat required to heat 250 gallons of water to 140° F., which represents the average weekly usage of hot water by a family of four. Lagging the tank will reduce the heat loss by 75 per cent. If the boiler is operating continuously, the saving will amount to nearly a ton in a year which, with coke at £4 a ton, would cost more than the insulation (Ref. 11).

Lagging the tank will not prevent the cupboard from being used for airing purposes. Most airing cupboards get much too hot, and continuous over-heating is very bad for clothes and linen. Enough heat will still pass through the lagging to keep the cupboard and its contents warm and dry. If necessary the hot water pipes in the cupboard can be left bare or a small area of the top part of the cylinder jacket can be made removable.

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(*To be continued.*)

Architectural Competition in the Grand Manner

From Adamson's History of Perth, Vol. II, p. 139, 1774

'In the late concourse held by the celebrated Academy of St. Luke, Mr. Robert Mylne, Architect from Edinburgh, has gained great honour, by carrying off the first prize in the highest class of Architecture.

'The subject given out, was the plan, elevation and section, with a perspective view of a building for holding statues, inscriptions, &c. of great men, and a place adorned in the most magnificent manner for the use of public Academies: the whole to take up 3,000 brachios (near three English feet) of ground, and the competitors were allowed seven months to perform it in.

'On the 6th of September the drawings were given in, on the 7th the competitors made their provas*; in a few days after, the drawings were adjudged in presence of Cardinal Camerlingi; and the first prize was unanimously given to Mr. Mylne.

'On the 18th the great Sale in the Senatour's palace, in the capitol, was superbly decorated for the occasion. There were present sixteen Cardinals, all the foreign Ambassadors, most of the nobility, and a vast number of ladies and gentlemen of the first distinction from all quarters.

'Nothing could be more august and solemn more beautiful and elegant, than this assembly; nor could anything be more conducive towards striking an awe into the breast of our young candidate and his fellow praemiati, who were placed on a kind of throne, higher and more conspicuous than any of the rest.

'After an excellent oration, the praemiati were called each by his name, and that of his country; and medals, struck for the occasion, were delivered to them by the Cardinals. Two large silver medals of about five crowns value each, with the effigies of the present Pope, on the one side, and on the reverse St. Luke painting the Madonna, were presented to Mr. Mylne by Cardinal Sacropanti, who paid him a very high compliment on the merit of his performance. Then the Cardinals and the nobility and gentry paid him their respective compliments as the first Briton that ever gained the prize. The Acadian poets rehearsed Sonettos, in honour of the victors, and the whole was accompanied by the finest symphonies of music.

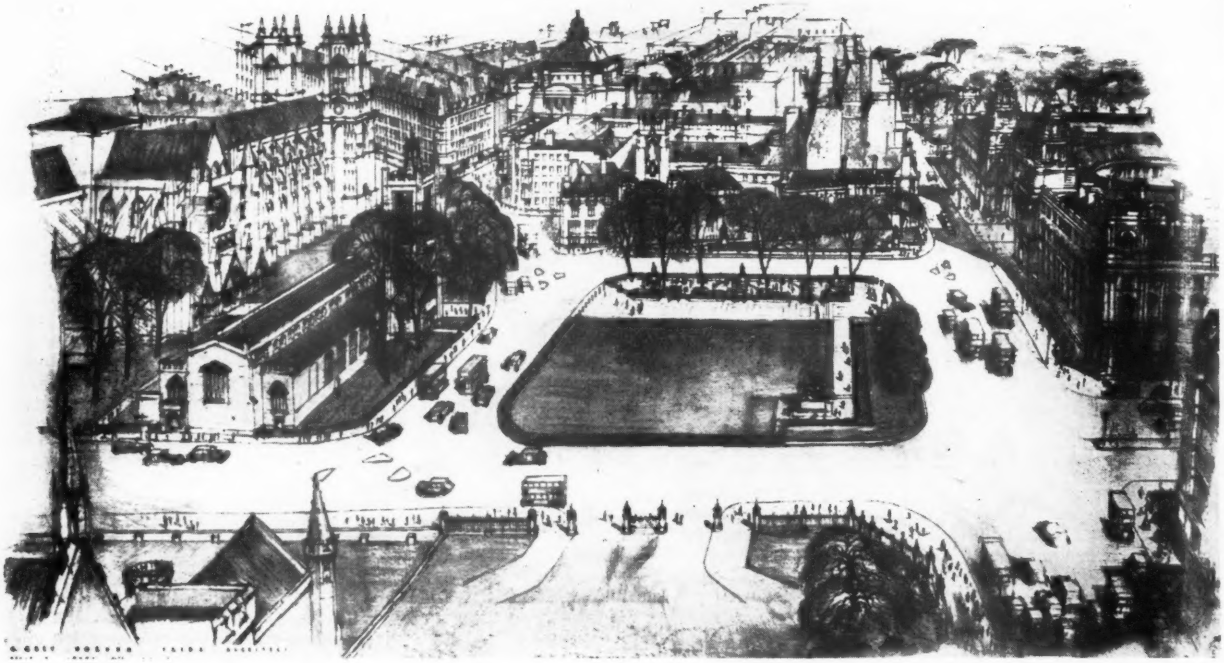
'The concourse of St. Luke is extremely grand; like the famous Olympic games, it is held but once in four years; like them too the great men from all quarters assemble to compete for the prizes, which, like the celebrated rewards of ancient Greece, are valuable, not for their intrinsic worth; but as they indicate the highest merit in the persons who acquire them.

'What a glorious thing is it for a young man, a stranger, unknown, unsupported, to carry off the highest prize, in the highest class of that noble branch of the arts and sciences, from the representatives of the whole world assembled to dispute it with him! and that in Rome, too, where all the arts, and architecture in particular, flourish in the greatest perfection!—Such a recent instance of merit rewarded must engage youth to exert themselves and infuse into them a noble ardour to excell, as they see that merit alone, unassisted, frequently gains the ascendant over interest, prejudice and envy.

'It is to be observed to the honour of Mr. Mylne, and the person who gained the 2nd prize, that he was the first to own the equity of the decision, and to congratulate Mr. Mylne on the justice that was done him. It is also remarkable that the predecessors of this gentleman have been Master Masons to the Kings of Scotland by patent since the reign of James III.

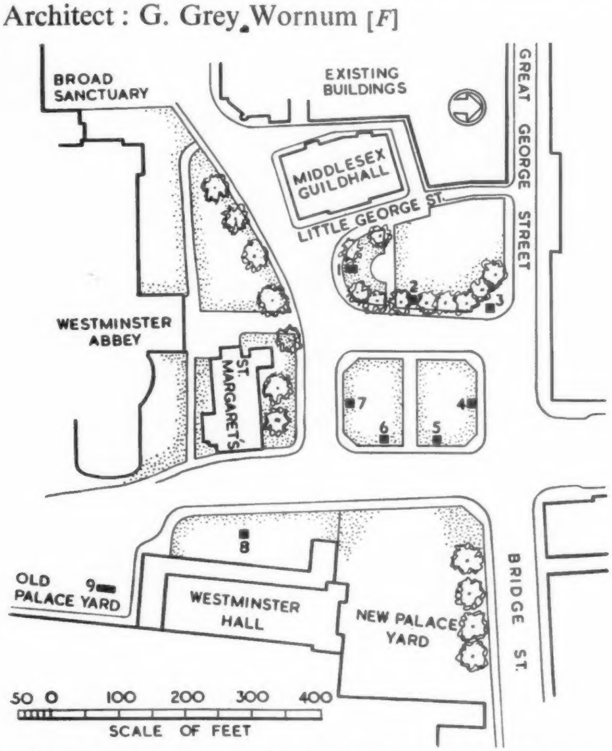
'In the following year the celebrated academy of St. Luke unanimously received Mr. Mylne a member of their body, as a further reward of his superior merit; on this occasion the young Prince Altieri, distinguished for his great knowledge of the fine arts, obtained from the Pope the necessary dispensation; Mr. Mylne being a Protestant.'

* A prova is a drawing made in presence of the Judges, in order to prove that what each person gives in is his own performance. The piece given on this occasion to the competitors of the first class was an altar adorned with composite columns, which they were obliged to perform in two hours.

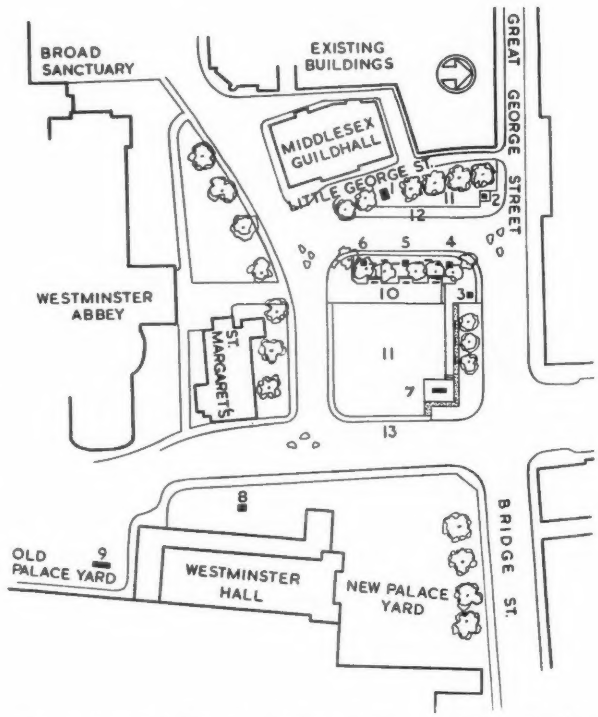


The Replanning of Parliament Square

Architect : G. Grey Wornum [*F*]



Plan as existing. Key: 1, Abraham Lincoln. 2, George Canning. 3, Buxton fountain. 4, Peel. 5, Palmerston. 6, Derby. 7, Beaconsfield. 8, Cromwell. 9, Richard I



Plan as proposed. Key: 1, Abraham Lincoln. 2, George Canning. 3, Palmerston. 4, Beaconsfield. 5, Derby. 6, Peel. 7, A future monument. 8, Cromwell. 9, Richard I. 10, Paved walk, seats, statues. 11, Lawn. 12, Pavement. 13, Low hedge

Above: view from the new garden. Below: towards the abbey. The perspectives are by Denis N. Jones

THE SCHEME OF REPLANNING PARLIAMENT SQUARE, now under official consideration, is governed by several limiting conditions. The Ministry of Transport wish for one central island to be planned as long weaving lengths for traffic on all sides. The Metropolitan Police are particularly anxious that no pavement be provided round the island, and that pedestrian access to the new garden be provided only from road islands as shown on the plans. The underground railway runs diagonally across the square at a few feet beneath the surface, so that subway approaches are impossible.

A feature of Mr. Wornum's scheme is a broad pedestrian walk across the square aligned on the axis of the north transept of the Abbey. The only existing trees will be on the west side of this walk; the four existing statues of past Prime Ministers will be resited on new pedestals in a terrace garden containing the trees and with flower beds and large stone jardinières. The remainder of the island is to be grass lawn except for a paved walk, with flower beds on the north side, leading to a site for some future public monument. This monument would be well seen from the Whitehall approach to the square. Pending the creation of such a monument, it is possible that an existing statue or group of statues might be moved there temporarily.

Generally, the island will be surrounded by a 7 ft. thick hedge and dwarf stone wall except at the north-east corner round the site for the new monument where the lawn would finish flush with the top of a low stone wall; this would provide a good view of the flower beds and give a good appearance on the approach to the square from Whitehall and Bridge Street. The statues of Abraham Lincoln and Canning would be moved slightly from their present positions, but would still occupy a garden site on the west side of the square.

The scheme, if adopted, will be put into execution at once, mainly to improve traffic conditions for the 1951 Exhibition. The public authorities involved in the scheme are the Ministry of Works, the Ministry of Transport, the Metropolitan Police, the London County Council, the Westminster City Council, the Middlesex County Council, and the authorities for electricity, gas, water, post office, etc.

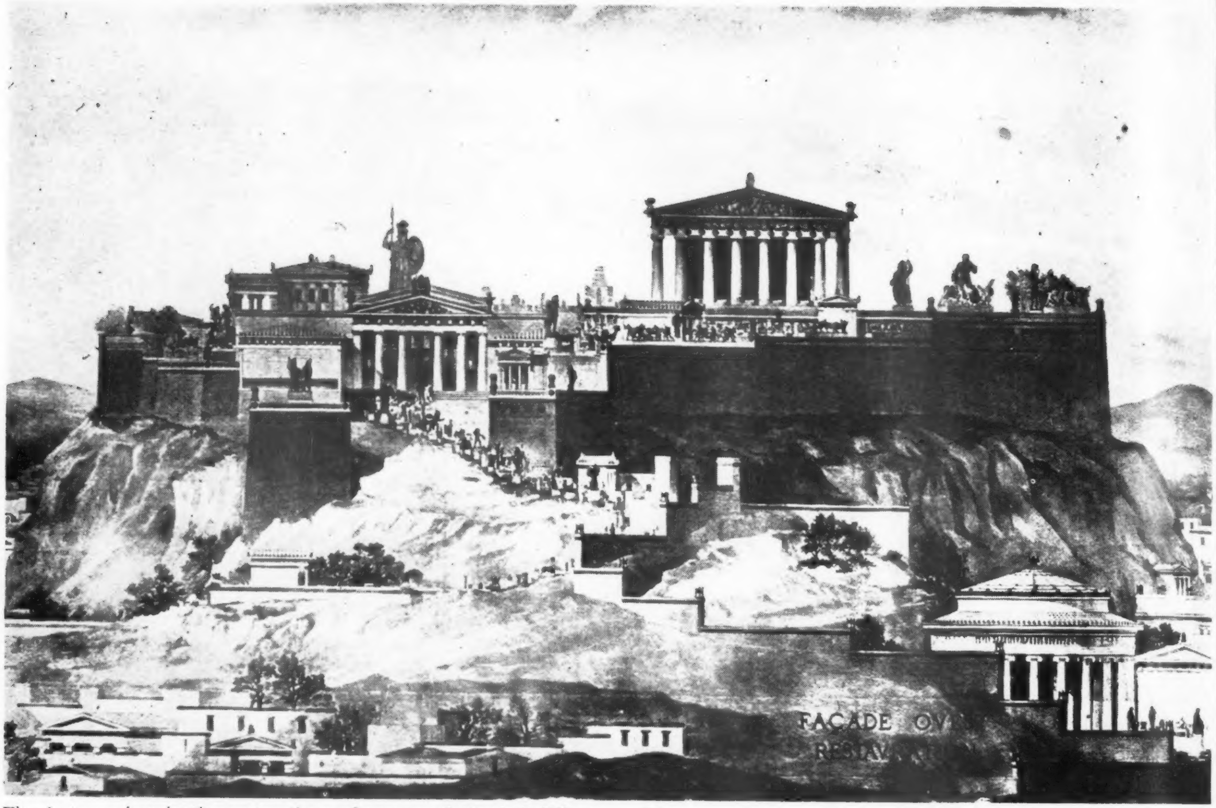


Fig. 1: '. . . imaginative restorations of groups of Greek buildings . . .'

Measured Symmetry in Architecture

By W. P. Hunt, M.A. (Cantab.), A.M.T.P.I. [*A*].

Athens Bursar 1947

'The antique never surprises, never gives that gigantic and exaggerated effect. One finds oneself at ease with those admirable creations; reflection alone makes them seem big and places them on their incomparable height.'—Delacroix.

OPPONENTS of forced and extensive symmetry in design have always liked to feel that in adopting irregularity in their architectural or landscape compositions they are working in a manner which appealed to the ancient Greeks themselves. Though we are now almost too familiar with the great imaginative restorations of groups of Greek buildings (see Fig. 1) to be moved by them any longer, we continue to ask whether the Greeks thought as intensively about the siting of buildings in relationship to each other, to their terraces and to the shielding walls of temenos or citadel as they did of the modelling of their orders and of their sculpture, and whether, too, the appearance of all these was carefully considered as being an organic part of the surrounding country. If we could be sure that the balance of these compositions, simple in their form yet rich in detail, was the result of deliberate intention then we should know that the insensitivity of the symmetrists of the Grand Manner could no longer be flatteringly described by the hallowed word 'classical' without considerable qualification. The support of the Greeks in this matter would be more authentic and substantial and consequently much more highly valued than that provided by the scene painting architects of the 18th and 19th centuries whose passion for pictorial composition was seldom matched by a similar interest in purely architectural values.

Descriptions of Greek sites by modern writers show that there are two distinctly different conceptions of the way their arrangement might have evolved. There is the architect or town-planner who sees all sites and restorations through the eyes of an engineer of Imperial Rome or a L'Enfant and describes their layout in some such terms as 'brutal,' dismissing them without further thought, though he may value the detail of the individual buildings and indeed go to some trouble to show its superiority over that of Rome and the Renaissance. But in the second school there is as strong a liking for unified landscape designs as for the profiles of structural and decorative form. Choisy[1], Unwin[2] and many more have seen in the disposition of buildings and statuary a balance which they have believed must have been the result of original intention. In his *Town and Country Planning* Sir Patrick Abercrombie supports this view.[3] M. le Corbusier goes further and in his most sensitive description of Greek building in *Towards a New Architecture* he tells us that the Parthenon was so sited on the Acropolis as to appear framed by Mt. Pentelicus when seen from Piræus. An assertion which, if true, would mean that the Greeks had a fully developed sense of landscape composition. But the extremists of this school go beyond this, either by trying to prove the existence of a mathematical relationship between all buildings on their respective sites, including buildings the restoration of which is conjectural, or more humanly they may, with Mr. March Phillips, 'have sometimes wondered if the position of the hill had not something to do

[1] Choisy, A. *Histoire de l'Architecture*. 1899.
[2] Unwin, Sir R. *Town Planning in Practice*. 1932.
[3] 'The Athenian Acropolis is the best example of this studied picturesqueness of grouping, which cannot be explained on religious grounds.'

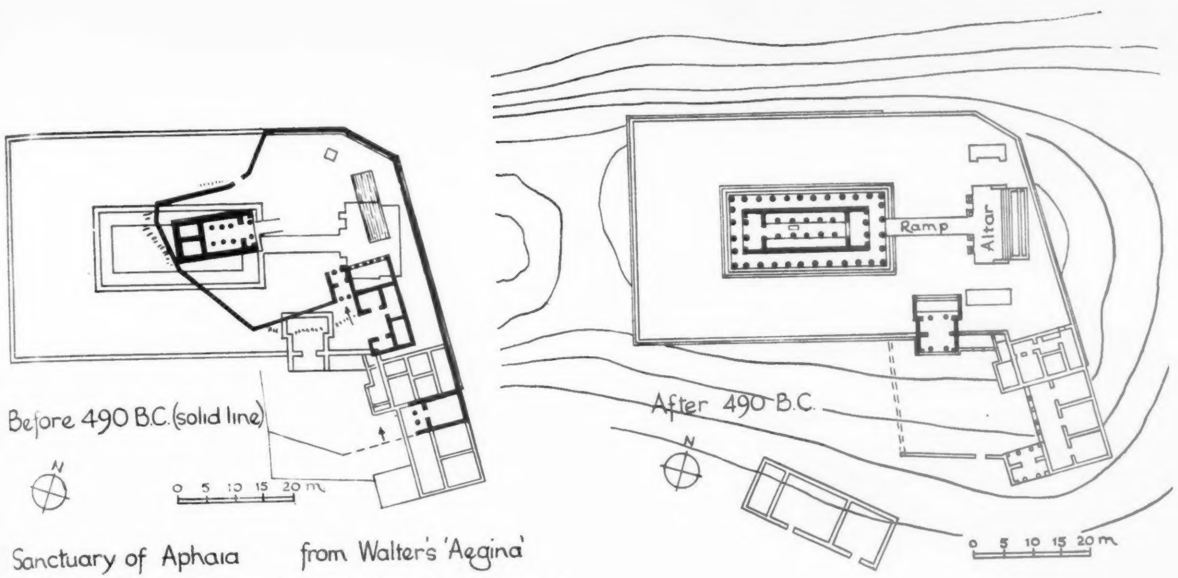


Fig. 2: 'In the later scheme we see the introduction of the right angle'

with the choice of the position for the city, which seems to have been drawn hither from its more natural site near the Piræus, in order that it might take advantage of such an opportunity for the proper display of its precious works of art.'[4]

If we wish to find out how the Greeks of the 5th century liked to relate their buildings to one another, when offered the chance of doing so, perhaps the most informative plans to study are those of the sanctuary of Aphæa at Ægina as existing prior to 490 B.C. and as rebuilt at about that time, some years, it will be noted, before the rebuilding of the Acropolis at Athens (Fig. 2). In the later scheme we see the introduction of the right angle. Had there been a Greek theory of the Picturesque the opportunity given by the rebuilding would probably have led to the retention of the original layout, in which there is no 'parallelism,' (or, had that by some chance been regular), to its abandonment. But instead we find the new scheme a most orderly one, the buildings keeping their former position, but being made truly square with one another.

This, and similar small examples elsewhere, might be thought to have been the products of local schools of thought, outside the main stream of architectural development, but we are now able to see how an attempt was made to do the same thing at Athens when the Acropolis was rebuilt after the Persian wars. This has been made possible by the researches of Mr. G. P. Stevens,[5] late Director of the American School of Classical Studies in Athens. But as the problem of rebuilding was so complex and hedged about by difficulties the picture of what was intended is not nearly so clear as at Ægina where there is what amounts to a forthright statement of principle. In the Acropolis we now see not only the familiar symmetry of the individual buildings, but an attempted regularity in their relationship achieved by the use of the right angle, principally in what Mr. Stevens calls the Periclean Entrance Court, where the new Propylæa[6] was built parallel to a high Mycenæan wall, which ran roughly north and south behind the statue of Athena Promachos and which is the most interesting feature of his restoration (Fig. 3) and for the continued existence of which in the 5th century very convincing evidence is shown.

To the south of this court a new boundary wall was given to the Sanctuary of the Brauronian Artemis built perpendicular to the Propylæa, and to the north of the court, as Mr. Stevens says, 'the so-called Heroon of Pandion was already perpendicular to the new Propylæa in so far as the eye was concerned.' The wall built to support the north terrace of the Parthenon was also roughly perpendicular to the court, being at right angles to the Mycenæan wall.

From these new restorations too it is quite clear that the buildings of the Acropolis formed no picturesque or balanced composition as few could be seen together from any one view point either within the walls or, indeed, from the city below, for the Parthenon and the Erechtheum must have been as fully screened by the Acropolis wall in antiquity as they are today. We are accustomed to seeing the Acropolis in elevational drawings or bird's-eye perspectives which do not really represent a normal view either from the foot of the rock or from the surrounding hills. But whilst these are all highly imaginative they are no more inaccurate than the perspective[7] shown in Fig. 4, one of a number of its type, which has been drawn to prove how a balance of forms was obtained by the use of related angles, and is based on quite as faulty a restoration of the site, as it existed in the 5th century, as any of the Beaux Arts restorations. This view should be compared with that drawn by Mr. Stevens (Fig. 5) showing just what could, in fact, be seen by the traveller who has just passed through the Propylæa.

The Stoa of the Brauronian Artemis and the wall surrounding the Parthenon's western court screened all but the pediment of that temple and of the Erechtheum little more than the north portico was to be seen. It seems very clear that the buildings were so placed as to look well from the entrance propylon—a sort of classical 'claire voie'—to their respective courts or precincts, and that together they did not form what today we call a civic group. This near view was in practice Plato's 'favourable point of view' from which 'proportions will seem to be beautiful.' It may be noted that the route to the east front of the Parthenon is a street of the same width approximately as the main streets at Priene and, I think, must have been thought of as a street, from which opened gateways to the temple courts, rather than as part of a serpentine way between a *group* of buildings. The Acropolis was literally a city. These points are brought out clearly in the illustration of Mr. Stevens' model showing the Acropolis, as it existed in the 1st century B.C. (Fig. 6).

That Piræus was laid out on geometric lines by Hippodamus at about the same time as the reconstruction of the Acropolis has been explained as illustrating the co-

[4] March Phillips, L. *Form and Colour*. 1915.

[5] The papers of Mr. Gorham Phillip Stevens have not been published in this country. A brief but enthusiastic description of his work was given by the late Theodore Fyfe in the *R.I.B.A. Journal* in 1937, and again in 1939. Mr. Stevens gave a talk at the R.I.B.A. in March, 1939. His published papers on this subject are:
'Periclean Entrance Court of the Acropolis of Athens,' *Hesperia*, Vol. V, No. 4. 1936.
'Setting of the Periclean Parthenon,' *ibid*. Supplement No. 3. 1940.
'Architectural Studies concerning the Acropolis of Athens,' *ibid*. Vol. XV. No. 2. 1946.

[6] The earlier and more 'picturesque' Propylæa bore no such relationship to this wall but was at a considerable angle to it.

[7] From *Raumordnung im griechischen Stadtebau*, by D. A. Doxiadis. 1937.

existence of formal and informal schools of thought. It would now appear that complete regularity was always aimed at, though sometimes capable of only partial attainment. It will, however, be observed that the arrangement of buildings in a gridiron street pattern does not mean that they can not be viewed in three dimensions, provided that there are reasonably frequent cross streets. This plan gave the Greeks their limited objective, namely, a sculpturesque view of each building.

Had the Greeks been able to foresee what the rectilinear plan was later to become when carried out on a large scale with its dimensions limited only by the horizon, they would have doubtless questioned this approach to town planning; this they never did, except on military grounds (straight streets being less easy to defend against an attacker than torturous ones), because the size of the city states of antiquity bore no relation to their fame and they were often little greater in extent than a central park of a modern metropolis. None of them was large enough to contain the boring and fatiguing vistas of many later towns.

In spite of this striving for regularity and for the carrying into a building's surroundings of that orderliness which they gave to its plan, did they have an eye for landscape composition, and so site their buildings that every advantage was taken of natural features? Or have their hill-top shrines and settlements that fortuitous beauty commonly possessed by such buildings everywhere? Here we may again be disappointed to find that the Greeks did not see landscape features as components of design, as we see them today. There is no reason to doubt the broad conclusions of classical scholars on the Greek conception of landscape, described by E. M. Cope in *The Taste for the Picturesque among the Greeks* in 1856, and also by Ruskin in his essay *Of Classical Landscape*;[8] though recently lovers of Greece and of nature have tried without success, I think, to disprove them.[9] Ruskin, it would appear, was right in saying 'I can not too strongly mark the utter absence of any trace of the feeling for what we call the picturesque, and the constant dwelling of the writer's mind on what was available, pleasant or useful.'

Plato's description of the changed landscape of Attica shows how a good landscape was regarded as a fruitful one. 'All the richer and softer parts of the soil have fallen away and the mere skeleton of the land is left. But in former days and in the primitive state of the country, what are now mountains were only regarded as high hills; and the plains as they are termed by us of the Phelleus were full of rich earth, and there was abundance of wood in the mountains. Of this last traces yet remain, for, although some of the mountains now only afford sustenance to bees, not long ago there were to be seen roofs of timber cut from the trees growing there, which were of a size sufficient to cover the largest houses; and there were many other high trees, bearing fruit and abundance of food for cattle. Moreover, the land enjoyed rain from heaven year by year, not as now the water which flows off the bare earth into the sea. . . . the fact is, a single night of excessive rain washed away the earth and laid bare the rock.'[10]

At a time when the Greeks were building the temples which we would like to think were sited for picturesque effect, landscape was thus being analysed, not in terms of form, but of productivity, of soil, timber, food and water. The ideal landscape was the rich pasture land of the Elysian Fields, not of rugged Greece. This tends to confirm our belief that in the history of the appreciation of form, humanity has followed the child's development, finding delight in animated nature first, in animals and birds, then in trees, and in mountains last of all. How otherwise can we explain, for instance, the paucity of reference to Mt. Lycabettus by Greek authors, in spite of its being the most striking feature of the Athenian landscape? (In the 19th Century, Ziller, more alive than the ancient Greeks to the charm of Lycabettus designed a splendid little gazebo for its slopes, from which the city was to have been viewed.) It

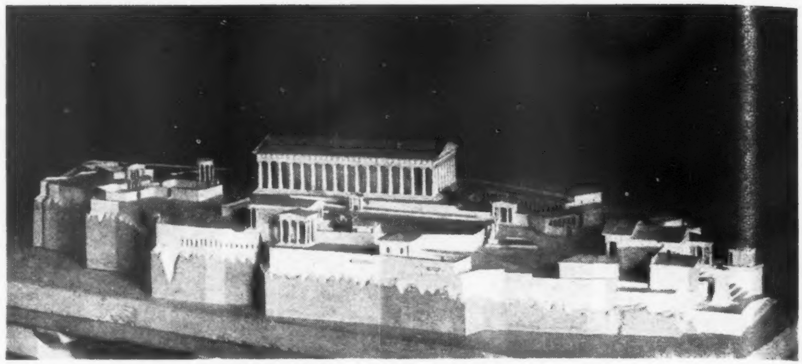
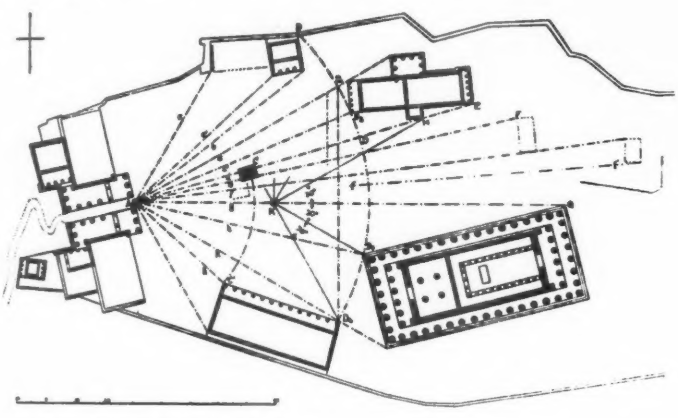


Fig. 3: Restoration of the Acropolis at Athens by G. P. Stevens

Fig. 4: '. . . highly imaginative they are no more inaccurate than this perspective . . . one of a number of its type . . .'



Setting-out plan of the perspective in Fig. 4

[8] Ruskin, J. *Modern Painters*. Part IV. Chapter XIII. 1856.

[9] H. R. Fairclough's *Love of Nature among the Greeks and Romans*, 1930, presents this later view.

[10] Plato, Critias III. Trans. T. R. Glover. *The Greek and the Forest*. 1928.

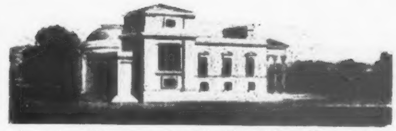
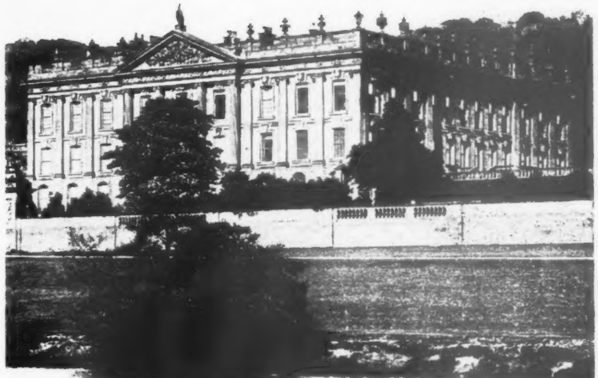


Fig. 8: 'It was inevitable, therefore, that someone should propose an Irregular Grecian'

Fig. 5: Left: Restoration of the view from the Propylæa into the Acropolis. From a drawing by G. P. Stevens

Fig. 7: Below: '. . . the sight of the skin-deep Palladian façade, torn from its context, as it were, in the streets of Vicenza, being grafted on to the four sides of a great cube'

Fig. 6: The Acropolis in the first century, B.C., by G. P. Stevens



is important to note that in the Hellenistic period, when there was just perceptible among the Greeks the growing of a romantic love of landscape,[11] we see the emergence of the completely regular civic group and the regular town,[12] showing that this romantic feeling for nature was not strong enough for the Greeks to be aware, as were the architects of the 18th century England, that the resultant rigidity might rob a composition of that movement and balance so necessary for pictorial effect and of the intricacy 'that leads the eye a wanton kind of chase.' [13] It is doubtful, too, whether even in this period any Greek *consciously* perceived that there was a particularly happy relationship between his buildings and their surroundings, for it is only when buildings become inhumanly massive and too rectilinear to be responsive to movement of landscape, or foreign in material and discordant in colour, that it is noted with such displeasure how incapable they are of assimilation, and then, and then only, are principles and rules discussed which might prevent a repetition of their offensiveness. The Greeks knew nothing of such buildings. Never had a people less need for a theory of the Picturesque. This emergent feeling for landscape, was never sufficiently developed for us to consider it a possibility that the Parthenon was sited to appear framed by Mt. Pentelicus when seen from Piræus, as M. Le Corbusier suggests. Indeed, a less poetical traveller will observe that it is not possible to place the Parthenon anywhere on the Acropolis without the mountain appearing in the distant background when viewed from the port. This theory seems almost more extravagant than a charming 19th century belief referred to by E. M. Cope[14] 'that the siting of the Greek theatres showed a love of beautiful scenery, since an excellent view was to be had from each of them.'

Seeing the use of this simple rectilinear planning and the absence of conscious interest in landscape composition we might be encouraged to return to the 18th century view of classical Greek architecture, namely that it was a matter of the orders, and the profile of roof lines and of mouldings, and nothing more; and indeed, we might be tempted, in studying *plans alone* to join the critics who have declared the grouping of these buildings to be 'barbaric.' But whilst we must abandon our comforting hope of being able to say that the Greeks were supporters of balanced and picturesque architecture,[15] we are forced, if we approach

[11] Described by S. H. Butcher in 'The Dawn of Romanticism in Greek Poetry,' in *Some Aspects of the Greek Genius*, 1891.

[12] Priene is especially famed as an example of the imposition of a geometric plan on unwilling contours.

[13] Hogarth, W. *The Analysis of Beauty*. 1753.

[14] Cope, E. M. *Opus cit.* p. 151.

[15] They were perhaps too conscious of the chief drawback of irregularity to notice any possible virtues in it. This is, that whilst such an arrangement may be satisfactory as a composition from some quite important viewpoints, yet from many others it may definitely not be so. The Propylæa are less impressive than any Roman triumphal arch, for looking back on the latter after having passed on along the axial way one can recall impressions felt on first approaching the arch, feeling again the same powerful sensations. But from above the Propylæa appear to be sliding down the Acropolis slope. Far from recalling one's earlier thoughts one almost feels one has been tricked. As Shenstone knew, in the scenic landscape there must be no going 'backstage'.

the Greek sites with mental freshness, to see the powerful attraction of a *combination* of symmetry and irregularity not demonstrated so effectively elsewhere and none the less an object lesson for its having been accidentally evolved. Here we are learning something from the Greeks of those larger aspects of design with which they hardly concerned themselves.

The success of these compositions suggests that in grouping buildings, whether in a flat or undulating landscape, we should not necessarily follow one of two opposing methods namely the planning of irregular buildings—usually in an 'informal' scheme, *or* symmetrical buildings—usually in a 'formal' one, but should rather insist on symmetry and broad unbroken planes[16] for the principal mass, which should be of a limited size and then depart either into irregularity and broken planes, or, into the balanced combination and linking together of other varied but symmetrical shapes, similarly restricted in magnitude. The Greeks had no reason whatever to discuss a possible need for the limitation of symmetry or of magnitude because their largest buildings were small, compared with those of subsequent eras. Eighteenth century writers, on the other hand, were vigorously debating these related questions, largely because they were often confronted with the sight of the skin-deep Palladian façade, torn from its context, as it were, in the streets of Vicenza, being grafted on to the four sides of a great cube (Fig. 7) which, though it might take its place unobtrusively in a compact town, refused to sit well in the English landscape, where the handling of mass was becoming recognized as being of greater importance than the 'copybook' treatment of surface. One of these men, Lord Kames, in his *Elements of Criticism*, said, 'Nature in organized bodies comprehended under one view studies regularity; which for the same reason ought to be studied in architecture; but in large objects, which cannot be surveyed but in parts, and by succession, regularity and uniformity would be useless properties, because they cannot be discovered by the eye. Nature, therefore, in her large works, neglects these properties; and in copying nature the artist ought to neglect them.' Such a view, of course, condoned the common practice of planning for any degree of symmetry in architecture (since Kames distinguished between architecture and such 'larger objects' as landscape features), provided that this formality was not carried into the landscape pattern, and it might have been responsible for the creation of another Versailles set in the middle of a *jardin anglais*. Sir Uvedale Price quoted Montesquieu's view on this subject: 'Things that we see at a glance ought to have symmetry; thus at one glance we see the front of a building, a parterre, a temple; in such things there is always symmetry, which pleases the soul by the facility it gives her of taking the whole object at once.' This would mean that the larger the structure the greater the need for symmetry in order that it should be easy to comprehend. These writers considered it was a case of symmetry or asymmetry. Burke alone, to my knowledge, understood, in a limited way—for he only seemed to be concerned with planes and not with volumes—that the battle was in reality between extremes of either when he wrote 'too great a length in buildings destroys the purpose of greatness, which it was intended to promote; the perspective will lessen in height as it gains in length; and will bring it at last to a point; turning the whole figure into a sort of triangle, the poorest in its effect of almost any figure that can be presented to the eye. . . . *A good eye will fix the medium betwixt an excessive length or height* (*for the same objection lies against both*), *and a short or broken quantity;* and perhaps it might be ascertained to a tolerable degree of exactness if it was my purpose to descend far into the particulars of any art.'[17] He never attempted to ascertain these limits, but abandoned such speculation for the surer ground of politics. The successors of Burke were the Picturesque theorists. Now, whatever these men might have originally intended, they made inevitable not only the abandonment of symmetry in architectural design, but of any regular shaped masses of appreciable size. The Grecian, they realized, had Picturesque qualities, but they found the symmetry which went with it, and which was rightly considered to be an essential ingredient of the style to be something of a stumbling block. It was inevitable, therefore, that someone should propose an Irregular Grecian (Fig. 8).[18] But as a building in this manner was difficult to contrive successfully, the use of our indigenous Gothic became more general. One of these theorists, however, a 19th century editor of an edition of Price's *On The Picturesque*, Sir Thomas Dick Lauder, in commenting on Hamilton's Calton Hill High School at Edinburgh, did show an appreciation of the value of a degree of symmetry combined with irregularity: '. . . it has often occurred to me that, for rural mansions, where Greek architecture was preferred, a very pleasing and picturesque effect might be produced by grouping the several temples irregularly together, though each particular portion should be perfectly regular in itself. I can conceive the effect of such a group, with its connecting passages covered by colonnades—and all its other additions of terraces, balustrades, flights of stairs, vases, statues and fountains intermingled with shrubs and plants of all kinds—the whole broken here and there by the intervention of tall trees, to be extremely interesting.' He added: 'A close inspection of the works of some of the best old masters of landscape painting, particularly of Poussin, would prove that they had discovered that such combinations were in some cases valuable for their art' (Fig. 9). This picture's effectiveness is largely due to the symmetry of the central building. But such appreciation was confined to a few and was never expressed as a principle. Certainly not one imposing a limitation of any sort on maximum or minimum unbroken volumes. It was only to be expected, on the other hand, that just as the Renaissance garden designers carried architectural form on and on into the landscape, so, once natural form was admitted as an alternative, this should, in its turn, tend to dominate and almost completely overwhelm architecture. There is unfortunately no appeal in the advocation of a mean, for it imposes restraint and this is irksome both to fevered and to rule-of-thumb creation.

Lauder's brilliantly conceived composition is what we should like to think the

Fig. 9: Landscape by Poussin

[16] Unbroken planes are necessary for the appreciation of symmetry, for though a highly complex arrangement of broken forms may be symmetrical about a central line, one is not always conscious of the symmetry, except when on that line.

[17] Burke, Edmund. *Philosophical Inquiry into the Origin of our Ideas on the Sublime and Beautiful*. 1756. Part II. Section 10.

[18] The development of this 'Irregular Architecture' is described in Christopher Hussey's *The Picturesque*. 1926.

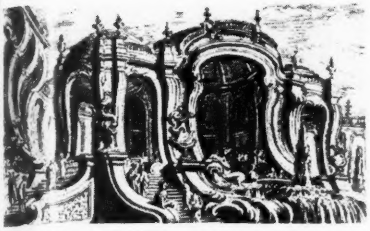


Fig. 10: '. . . Meissonier's contorted grotto . . .'

Greeks had striven for in the Acropolis and elsewhere, but though it is unlikely, as we have seen, that they had any such purpose, they by accident achieved it; but having achieved it, they did not value it, but set about their planning, as opportunity offered, in the manner which is popularly known as Roman or American.

Those who have not been fortunate enough to travel in Greece may see an illustration of this idea, though less forcibly expressed, in many an English country town where a few of the principal buildings, such as the town hall and the market hall, which might date from the 18th century, are symmetrical in design and are composed of simple, unbroken masses of substantial size, but are informally and loosely related to each other and to the smaller buildings around them. These towns we all know form a more suitable background to a balanced human life, than do the towns in the so-called 'Grand Manner,' with their aridity, or in the Picturesque style[19] with their pettiness and their lack of architectural form and æsthetic stamina. In Greece, and particularly in the Athenian Acropolis, the vitality of vibrant symmetry and sustained magnitude seen together with informality is overwhelmingly more striking, because of the superb and unsurpassed beauty of the architecture itself and the conditions of lighting under which it is to be seen.

Had Burke pursued his inquiry further, following his contemporaries in their travels he might well have declared the dimensions of the Parthenon to be the desirable mean. But it is doubtful whether he could have given a reason. It is useless to attempt exactitude, but there, one feels, is that essential unbroken length and breadth and height of which he wrote. It might be objected that this mean will vary in size with many other factors including the size of the town and number of its inhabitants, and the relative openness and general form of the landscape, especially the latter. But this, I submit, is not so. A building is principally related to the human figure. This *personal* relationship with the Parthenon, the central shrine of a small, self-governing city state, contrasts with that feeling which is imparted by the world's larger buildings[20] of being related not to oneself and to one's fellow townsmen, but to a nation or empire of many unseen and unseeable millions the very existence of which cannot be proved *visually*. We know that the greater these numbers are, the more inhuman are the buildings which represent them, when brought into contact with the constants of the landscape, with men and with trees and flowers. But though there are times when almost all of us respond to megalomania in building, or on the other hand, to almost complete rusticity, such transitory extremes of feeling, one feels, should not be catered for in architecture. The extravagancies of the Sublime for instance can best be expressed in other art forms, or by the contemplation of the 'awful' scenery of mountain and cave.

Though the Parthenon is often described as being large in scale, it is, by our standards, extremely small in mass, being merely about 230 ft. by 100 ft. by 45 ft. It is barely large enough to dominate the Acropolis, even in the latter's denuded state. It is worth noting, for the sake of comparison, that the entire rock itself is just about the same length as the Palace of Versailles. The Parthenon's unbroken volume[21] lies between the extremes of that spiritless mass and Meissonier's contorted grotto (Fig. 10)—the manifestations of the two ever-present tendencies in architectural design; and between L'Enfant's Washington and mediæval Nuremburg lies the Acropolis grouping. Symmetry, so far, then by the good fortune of historical accident, irregularity and balance.

It is not suggested that even where we have full freedom of choice we should restrict the dimensions of the primary masses of our buildings to the size of the Parthenon. No particular value can be attached to its exact dimensions, since the detailed architectural treatment of a mass affects its apparent size. But if it is agreed that there is a mean between too great a regular volume and one which is too broken, we can, with sensitivity, find it for ourselves, by reference to the human figure and the constants of the landscape, rather than to any formulæ. Hitherto, there has been no such agreement.

The system upon which we organize our plans remains a subject for debate because we have an embarrassing freedom of choice in the matter. Historically, symmetry was the first method to be used. As Uvedale Price pointed out, symmetry is the most elementary arrangement. The deliberate adoption of asymmetry, unless made necessary by the site or by the great inequalities of the parts of a building, would have seemed absurd before the days of the architect-painter.

Asymmetry has been the rule for many years and is regarded by most architects as being a *sine qua non* of contemporary design. The reason for its ubiquity is not hard to see. It is not for its pictorial value in landscape—too many of the modern school have cared little for that—but because broken surfaces provide 'interest' and, with their shadows, a suggestion of decorative pattern which is otherwise lacking in modern buildings. If we were to develop more decorative forms—or surfaces—once again we might welcome the intelligent use of symmetry. But at the moment it seems that there is a movement towards even greater irregularity, held in check only by the economics of our building technique. We have again become conscious of Nature. In recent years, if the architect looked beyond his drawing board it was to the laboratory rather than to the landscape; and he would use the hardest and shiniest of synthetic materials in the most delicate lichen-covered countryside without questioning their suitability, murmuring 'reactionary' at any protesting inheritor of the ideals of the 18th century. This change in outlook has been marked by a veritable outcrop of rubble walling not seen since Piranesi's days, which has provided a crude textural link with the roughness of the site. His growing interest now embraces the whole philosophy of the Picturesque, and whilst he was formerly engrossed only in the development of abstract and mathematical qualities, he now appears to be accepting uncritically all the whimsical eccentricities—the delight of historians—of the later undisciplined days of the Picturesque which were the product of exceptional times. For over a century these trivialities have effectively obscured the constructive elements of a style which should be noted for a breadth of vision greater than that of the Renaissance itself rather than for the journalistic appeal of its architectural bric-a-brac. Unfortunately, with this new enthusiasm there threatens to come an insistence on a universal irregularity in the cause of 'movement and intricacy' at the expense of the poise which we like to see in a work of art and which, as Greek architecture shows us, can best be obtained by a measure of symmetry.

It seems that on the long road back to an architecture with a generous appeal to more than the initiated, we are compelled not merely to stress one approach to design to the exclusion of others, but to find solace only in the most opposite extremes.

Acknowledgments.

The writer would like to express his gratitude to all who have given him assistance during his tour in Greece, and in the preparation of this report, and particularly to Mr. John Cook, Director of the British School at Athens; Mr. G. P. Stevens, late Director of the American School of Classical Studies, Athens; M. D. A. Fotiadi, Architect, Athens.

[19] See 'An Imaginary Irregular Town,' in Raymond Unwin's *Town Planning in Practice*.

[20] E.g. Capitol, Washington; St. Peter's, Rome; Rockefeller Centre, New York; Versailles, etc.

[21] In the Greek idiom, Alexander Thompson's Glasgow churches are interesting examples of the balanced composition of shapes which are themselves regular but the masses are, I feel, too small, and have more of the instability of the Erechtheum than the immutability of the Parthenon.

House Heating: Some Thoughts on Standards and Methods

By S. F. Newcombe

THE ARTICLE ENTITLED 'Warm Air House Heating' published in the June JOURNAL stated that convection heating, plus topping up by gas or electric fires, to comply with the Egerton standards, is unduly costly in both installation and running costs; it ended with these words: 'Whole house heating is certainly pleasant, but there is some doubt whether it can be afforded by the working class tenant.'

There is no doubt whatever that extremely few of any class of householder can afford today to heat the whole of his house to a high air temperature throughout the winter. Indeed, so to heat a whole room can be quite expensive. It is because heating engineers have assumed the heating needs of house occupants to be the same as those in hospitals, hotels and large buildings, that the Egerton Report and its terms of reference have been misleading to architects and appliance makers. The basis of all studies of house heating should be the axiom that the house is to provide comfort and weather protection to the occupants *at a price they can afford.*

It is now well recognized that the plan and general design of the house and its structure, as well as the siting and type of heating appliance installed in it, affect the comfort of the occupants, the efficiency of heating and the amount of the annual fuel bill. All these are closely inter-related and ought to be considered as a single problem in providing comfort. However, while there is much confusion of thought arising from the slipshod terms used to discuss heating and heat transmittance, the major difficulty is that of measuring comfort.

What is comfort? Personal comfort depends on many different factors: these are difficult to define, are intricately inter-related, and may vary by as much as 100 per cent in 24 hours. The same person changes his needs and ideas of comfort very largely in one day, and tremendously in his lifetime. People in their youth in the nineties took pride in sleeping with open windows and in finding ice in their wash basins: in their old age they shut windows in winter—except for half an hour only in the warmest and driest time of the day—conserving heat and health, yet with ample air change in the ordinary house. They find, too, that they need more insulation in bedclothes and overcoats than they did; they no longer despise the hot water bottle. The American shivers in our houses, while we gasp for air in his. What, indeed, are 'comfort conditions'?

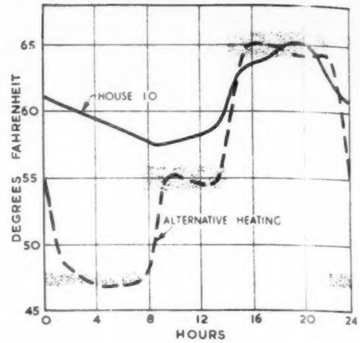
The metabolic rate per person in B.Th.U. per hour is very small. The American Society of Heating and Ventilating Engineers' Guide (Chapter 12) quotes sleeping 255 B.Th.U., awake 300, seated 380, standing 430. Pilots in insulated planes at 35,000 ft. and −40 deg. F. wear electrically heated overcoats, over their normal uniforms, having a heat input of about 100 B.Th.U. per hour only.

It is possible to be some 10 deg. to 20 deg. warmer in the sun in England than in the shade. We all like radiant heat in a room, partly because our climate is cloudy and partly because we can avoid the extra heat if we wish. People pay to sit out in the sun with dry, still air at 20 deg. F. at 6,000 ft. in Switzerland and find no 'sensations of discomfort'. Nor do they feel discomfort in a room with radiant heat on one side and a screen or warm wall on the other, though they might feel discomfort with a window or cold wall behind them, partly because the surface temperature of the window or wall may be 20 deg. less than that of the warm side of the room but, more likely, because of draughts. If the air temperature inside is 60 deg. and outside is 30 deg., the wall surfaces may be at 58 deg. (or more with radiant heat) and the window surface at 39 deg.

There is no such thing as an agreed true measure of comfort. Dry air is only one factor. Relative humidity, radiant heat and air movement are three others, but personal feelings vary the most. Dry air temperatures are accepted as convenient and universal, but the only person to say if he is warm enough is the person. To insist on a given air temperature in a given room, empty or occupied, as attempted in the Egerton Report, is just waste of fuel and money.

Times of Room Occupancy. Dr. Weston's paper to the Institute of Fuel on 2 March showed that under the routine imposed for the unoccupied period the air temperature of the living-room of House 10 at Abbots Langley had a minimum temperature of 57.5 deg. for 2 hours, a mean of 60 deg. for 24 hours, and during 8 hours of occupancy, 62 deg. for 2 hours and 64 deg. for 6 hours (see Fig. 1). A curve of alternative heating on Fig. 1 shows how a saving of some 30 per cent of fuel might be obtained without extra cost in building or appliances and with greater flexibility in the heating of the room, and probably equal comfort for the occupants while they are in it.

One must accept for test purposes definite hours of occupancy in a room; in practice it is probable that living rooms, or any single room, are not occupied daily in winter for over five hours (instead of eight), except when people are in bed, if the average is taken over the whole population. If this is accepted, the saving is likely to be greater than the alternative curve in Fig. 1 suggests, because even if the mean occu-



The shaded areas represent the required temperatures

pancy is eight hours the actual occupancy will be nil in some cases, varying to ten in others: one will save on the nil without much increase on the over eight hours.

The Variability of the Climate of Britain. In all rooms an average heating figure may give widely erratic results because the margins of error are so wide. Solar heat entering windows may raise room temperatures considerably, even in winter. More important, the outside air temperature can fluctuate rapidly in Great Britain. Table 1 gives the mean, and the absolute, maximum and minimum temperatures daily at Kew for winter months. The greatest change in one day was about 50 deg. in an exceptional case; at Rickmansworth on 16 April 1949 the temperature rose from 35.5 to 85.9 in eight hours. A change of 30 deg. in one day is not rare; the mean daily range is 10 deg. These big variations are not commonly taken into account in heating calculations in which a constant difference of 20 or 30 deg. between the inside and outside of the building is usually taken throughout the winter months. This difference varies daily, even hourly, so that needs of heating are always intermittent, even to keep the house warm and more so to give comfort.

Some very interesting points were discussed in Mr. Manley's paper on Microclimatology (R.I.B.A. JOURNAL, May 1949). It was shown that the maximum air temperature in S.E. England is about 100 deg. F., and the minimum is 0 deg. F. in Devon, 10 deg. F. in the Weald, and −20 deg. F. in low valleys in Scotland. In Aberdeen it was found that at an altitude of 250 ft. the air temperature was 9 deg. below that at 500 ft. at the same time. It is, in fact, often colder in the low valleys. There are thus many local variations in temperature, both in time and place which make slightly ridiculous (and costly) any proposal to heat houses throughout at a uniform temperature in the whole of Great Britain during the winter. Uniform heating is appropriate enough in continental climates (i.e. Middle West America and Central Europe) where there are uniformly low temperatures throughout the 'cold weather' period, but our so-called mild climate is a very different affair.

TABLE 1

Daily Maximum and Minimum Temperatures at Kew

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year	Period of years
Mean daily max.	45	46	49	55	63	68	71	70	65	57	49	46	57	30
,, ,, min.	36	36	37	40	46	51	55	54	50	45	39	37	44	30
,, monthly max.	53	54	60	67	75	80	81	81	75	65	58	54	85	35
,, ,, min.	22	24	26	31	35	42	47	45	38	32	28	25	19	35
Absolute max.	57	62	68	80	87	88	90	94	92	83	63	59	94	67
,, min.	9	11	17	26	30	37	42	41	31	25	20	11	9	67
Average 13.00	44	44	48	52	60	65	70	68	64	56	47	44	55	35
07.00 G.M.T.	89	87	87	85	81	78	80	85	90	91	90	88	86	35
13.00 ,,	81	73	63	62	58	57	57	61	64	70	78	81	67	35
18.00 ,,	84	78	69	66	61	59	59	63	72	80	84	85	72	35
Hours sunshine	44	61	103	149	203	199	195	183	145	93	53	37	1465	30
Av. daily ,,	1.4	2.1	3.3	5.	6.3	6.6	6.3	5.9	4.8	3.	1.8	1.2	4.	30
Ground (−10 ft.)	50			47						53			50	

What is insulation? Much is said today about insulation, especially the effect of wind and weather on the exposed surface of a house; but does one feel far colder in a train at 60 m.p.h. than when it is at rest? If the insulation is correctly placed and designed, that is to say as a damp proof (*i.e.* vapour proof) inner lining with very low conductance, solar heat, rain and wind should scarcely affect the inner temperature except on windows: U-values of the wall as a whole are of less importance than the nature of the inner lining and in any case U-values do not apply to intermittent radiant heating, but only to total heat loss.

Windows complicate the problem of house heating because they allow the sun to affect the internal heating arrangements. Not only do they do so in heatwaves, when the prudent housewife draws the curtains to keep the room cool, but windows obviously let the artificial heat out at night; one then draws the curtains, without thought, as much for warmth as for privacy. It is probably true to say that during the war the blackout saved as much fuel as would have been saved if all windows had had double glazing. A sunny day in winter can also raise considerably the temperature of rooms into which the sun enters so that aspect of rooms ought properly to be considered in any accurate control of heating. Aspect may be considered by heating engineers when designing a plant for a large building, but there is doubt if much consideration has been given to it in house heating research. Heating engineers, moreover, do not take into consideration the human action of drawing curtains when the sun goes down, nor has there been much consideration (other than a brief B.R.S. paper) on the design of curtains as heat insulators over windows. If a curtain could contain aluminium foil, it would be a very efficient insulator.

To use a simile which is perhaps not entirely inappropriate, one can say that people do not store petrol in a porous pot with a partly perforated lining on the outside. The lining should be inside and as petrol-proof as possible. If one substitutes heat for petrol, the traditional plastered brick walls of a house with windows for the porous pot, and a structure with a highly insulated impervious inner lining for the petrol-proof pot, one begins to see the direction in which building insulation studies ought to go.

Intermittent Heating. To return to the question of providing heating that the householder can afford, it seems wise to aim at providing heating in rooms *only* when they have human occupants. To achieve this the following three provisions, acting together, are necessary:

(*a*) Dry, damp proof inner linings to all internal surfaces of outside walls and roof.

(*b*) Some heat storage, *e.g.* in lagged hot water cylinders and in internal walls.

(*c*) Closely controllable heating appliances, correctly sited and suited to the size of each room.

The dryness and damp proofing of the inner linings are important, because much more heating, and hence time, is needed to dry a damp surface and then to raise its temperature, our goal being rapid heating up. We feel cold in damp caves, cellars, and to some extent in houses, because of the presence of cold walls round us. For quick warming it is the low conductance of vapour-proof inner surfaces, not the total U-value of the wall, which matters. Condensation (which can not be prevented on windows and tiled walls in kitchens and bathrooms) can be reduced by having warm wall surfaces and a little heat storage. Incidentally, little work, if any, has been done in this country on dehumidification in houses; in our damp climate it is a matter of some importance.

R. L. Davison, in reply to the writer in 1946, said that the quickest theoretical way of raising the air temperature of a room 15 ft. by 14 ft. by 8 ft. intermittently from 40 deg. to 65 deg. F. would be to provide it with an interior lining of copper or aluminium, backed with low heat capacity insulating material, and to provide as heat sources electric wires or coils in glass tubes at a dull red glow, these tubes being strung round the room just above the door and window height. On switching on the heat, the high radiation from these wires would make the occupant comfortable in a minute, although it might be 10 or 20 minutes before 65 deg. was reached. The occupant would feel comfortable because the temperature increase would reduce heat loss from the skin sufficiently to make possible a rise in the skin temperature of 1 degree in three minutes. The walls would be quickly heated up and then throw heat into the room by emissivity rather than by reflectivity.

This construction and heating method is not likely to be cheap to install, nor to operate; nor would many people like it; it is only given here for purposes of illustration. A more practical suggestion would be to make some alterations to House No. 10 at Abbots Langley, adding to the existing walls and ceilings a 2 in. mineral wool blanket on which should be fixed battens and plaster-board, thus forming an air space. The face of the plaster-board towards the air space should be covered with aluminium foil. A little extra heat storage might be provided within the house, say, another 40-gallon hot water cylinder, but the main heating of the room might be by gas radiators with aluminium reflectors designed to reflect radiant heat on to the floor and on to the limited available space where people sit. In addition various simple and inexpensive methods of reflecting radiant heat by screens or small reflectors, and of reducing draughts such as the effects of curtains or shutters over windows, might be tried.

House Design for Intermittent Heating. A thorough investigation of the problem of intermittent house heating, such as is outlined above, would naturally involve more considerations than the treatment of inner surfaces. It seems to point inevitably towards frame construction having wall panels with external faces to resist moisture and air leakage and with good appearance and ease of maintenance; inner linings to resist wear, fire, dampness (*i.e.* vapour-proof), good appearance, good acoustics, and above all constructed to heat up quickly, which means a conductance equal to 0.1 B.Th.U. Trying to improve the 11 in. brick wall is going in the wrong direction. The small degree of heat storage (in hot water systems, etc.) should be so placed that the heat from them warms the living rooms and principal bedrooms rather than the kitchen and first floor landing, as is at present the case with the common independent boiler and linen cupboard. There will be, of course, also some heat

stored in the inner walls, the furniture and in the ground from the radiant sources which are turned on from time to time.

The Abbots Langley experiment has shown clearly that a well-insulated house is slow to lose heat when all the heat sources are inoperative; if a house as has been described above is left unoccupied for some hours with all the windows closed, the inside temperature should be pleasant enough when the occupants re-enter and, when the appliances are turned on, should heat up rapidly to comfort conditions. Moreover, a heating system so closely controllable could allow for the widely-varying conceptions of what are comfort conditions, suiting the young, tough, warm-blooded as easily as the old or sick, sluggish-blooded. Finally, such a system would be likely to meet the purse of the poorer-paid householder, and if he found it did not, he could at least obtain some degree of warmth efficiently, at perhaps some sacrifice of comfort.

Review of Construction and Materials

This section gives technical and general information. The following bodies deal with specialized branches of research and will willingly answer inquiries.

The Director, The Building Research Station, Garston, near Watford, Herts. Telephone: Garston 2246.

The Director, The Forest Products Research Laboratory, Princes Risborough, Bucks. Telephone: Princes Risborough 101.

The Director, The British Standards Institution, 28 *Victoria Street, Westminster, S.W.*1. *Telephone: Abbey* 3333.

The Director, The Building Centre, 9 *Conduit Street, W.*1. *Telephone: Mayfair* 8641-46.

National Building Studies. Special Report No. 7 District Heating in American Housing, embodies the findings of a mission sent to America under the auspices of the Ministry of Fuel and Power. The Foreword points out that care must be taken in interpreting the term 'district heating', as in the States it is applied only to the heating of buildings in the commercial centres of the larger cities, from central boiler plants. There does not seem to be a generally accepted term for application to housing estates, though 'central heating' is often used, but when an estate has been subdivided for heating purposes into a number of groups of buildings, each served by a separate boiler plant, the term 'group heating' is employed. In the report 'district heating' is used in the British sense, and the signatories hope they have worded their report sufficiently carefully to 'overcome the barrier of our common language'. The most important points in the report are summarized as follows.

One of the objects of the mission was to find out to what extent American experience might be expected to hold good in Great Britain, and they chose the procedure of visiting a large number of places with differing conditions and climates, rather than that of examining a few schemes in detail. Visits were made to 80 district heating schemes of different kinds, and although not all the facts hoped for were available, yet at the end of their two months' tour the mission felt themselves to be in a position to answer the four questions, (1) does district heating work? (2) does it save fuel? (3) does it pay? (4) is it popular? Chapter 5 gives General Conclusions, which are: that in the U.S.A. district heating has for some time been applied to the heating of the commercial centres of many large cities, but its use in residential areas is a more recent development, and is largely confined to new construction; that local authorities providing low-cost housing have chosen the system for a high proportion of their projects; that it is the general practice for these local authorities to provide heat, light, power, and an unrestricted supply of hot water, the standard of house heating being about 70 degrees F.; that in general the tenant is not charged separately for the heating and other utility services; that in the general conditions of local authority housing, district heating affords a greater measure of control over fuel consumption than is possible with separate appliances in the individual dwellings.

On the question of fuel economy, the conclusions are: that there is clear evidence that district heating results in economy of fuel and that where the schemes are well designed the economy is substantial, and that the evidence of economy would have been general if the standard of temperature control had been universally high; that although the preference is for steam heating, hot water systems have been chosen for some of the more recent projects, doubtless on account of the greater ease of temperature control; that the major factor in determining whether district heating is economical is the difference in price between fuel supplied in bulk to a central boiler house and that supplied to individual consumers for their own heating system, and this generally operates in favour of district heating.

On the comparative costs of the system it is noted that local authorities are required to make a careful analysis of the costs before selecting district heating in preference to other systems. The capital costs of district heating are higher than those of individual installations, therefore—to show an overall economy—the costs of operation and maintenance must be substantially lower than those of alternative systems, and in the U.S.A. projects which will reduce running costs, even if they require a higher capital outlay, seem to be more readily acceptable than in England, but then in the U.S.A. the Government assists the finance of low-cost housing by meeting the deficit on annual running costs, instead of by capital subsidy. The majority of administrators of housing estates with experience of the system were in favour of it.

On the economic size of a district heating system the mission's conclusions were that size of scheme does not seem to be a major factor in determining economics, provided that the smaller schemes can be run by part-time labour, and schemes varying in size from 130 to over 2,000 dwellings are working with satisfaction to those concerned. The operating costs of group heating are almost twice as great as those of district heating, in comparable conditions, without apparent technical advantages.

The conclusions on structural insulation are that its wide-spread adoption in America has greatly reduced the amount of fuel required to maintain the standard of heating, but that this is not a major factor in determining the choice of heating over there.

Part 2 of the Special Report describes selected heating schemes, beginning with Seattle, which particularly interested the mission on account of the similarity between the climate there and in England, and also because the range and relative costs of fuels for domestic use were likely to provide useful comparison. Oil as fuel and hot water as the distribution medium were authorized, as the combination promised the most overall economy.

Parkchester is entirely supplied with heat and hot water from a single boiler-house, and is the largest installation serving residential premises in the United States; the total cubic content of the residential property being just under 120 million cubic feet.

In ending the descriptive chapter the report says that emphasis has been laid on certain parts of the district heating scheme, namely, on those areas where climatic conditions are close to those in Great Britain; on two-storey houses rather than on multi-storey flats; on low-rent housing rather than on the more expensive accommodation, and, on the technical aspect, on the minority of schemes using hot water as the medium for distributing heat rather than on the majority using steam. Therefore the selection of plants made by the mission must not be regarded as a representative cross-section of American practice. Had time (and paper for the report) permitted, many more schemes would have been described in detail, for instance, the garden city of Greenbelt, near Washington, one of the earliest examples of Government-assisted housing in the United States, with its 1,885 flats and houses, heated by a variety of systems. However, the leading particulars of those estates not fully described are tabulated in the fourth appendix.

Part 3 of the report considers costs and choice of heating systems. In America both the Federal Housing Administration and the Federal Public Housing Authority, or —to give the last their new title—the Public Housing Administration, exercise considerable influence over the trend of domestic heating practice, and the P.H.A. can give comparative data regarding the low-rent housing estates they supervise, although the statistics are not full enough to sustain rigid mathematical analysis; still, the general guidance given to the mission by the P.H.A. was of importance. Their Bulletin No. 20, 'Selecting a method of heating', sets out the considerations that should influence a local housing authority when deciding between district heating and separate appliances in each dwelling. The view of the P.H.A. is that district heating is to be considered only when the heating season lasts for at least four months. The Administration point out the effect the choice of heating system may have on site and building plan. District heating calls for the least possible length of distribution mains, but it eliminates the need for direct road access to each house for delivery of fuel and removal of ashes. The P.H.A. bulletin states that district heating is justified only where there is a 'concentration of dwelling units in flats and apartments and, *to a lesser extent*, row (i.e., terrace) houses.'

The report gives a table of available information regarding the 175 low-rent housing estates administered by the Public Housing Administration. 33 are heated by high-pressure steam from a central plant; 28 by low-pressure steam from a number of separate boiler-houses; 7 by purchased steam, taken from the mains of some independent authority; 1 by hot water from a single boiler-house; 5 by hot water from a number of boiler-houses; and 30 by independent boilers. No returns were available in regard to 22 estates.

The report then states: 'These figures present in summary form the answers given by American housing authorities to the questions raised at the beginning of this Report and is discussed in the preceding chapters: "Does district heating save fuel—does it pay—is it popular?" The evidence, indeed, is so impressive that it is only right to reiterate the elements in the American housing authority's choice of heating system which do not apply in Great Britain. First, there is the necessity of providing a high standard of space heating by whatever method, and the recognition of the desirability, as a matter of social policy, of making abundant supplies of domestic hot water available as well. Second, there is the general, although not universal practice of including the charges for the utilities in the rent which, as has been said before, must incline an economically-minded authority towards the system by which it retains most control of consumption. Finally, it is probably true to say that American experience of low-rent housing is based largely on multi-storey apartment building, and they have been influenced by the heating practice standard there in the extension of their building to two-storey cottages which are the primary interest of most British housing authorities.

'However, in considering the application to Great Britain of this general consensus of American choice, there are two other points that should also be stressed. First, though the economics of district heating in America are favoured by the high standard of heating that is maintained, the need to provide, over much of the country, for the possibility of very severe weather is a disadvantage in comparison with climates such as that of Seattle and Great Britain, where the heating season may be longer and shows less pronounced peak demands. Second, and perhaps more important, every item in the operating costs of district heating, except fuel costs, appears to be higher than in Great Britain, yet the American authority is prepared to incur heavy labour charges to reduce the fuel bill. Looking at the question from a national point of view, is there not a clear deduction to be made for a country where labour rates are less than half the American, but fuel prices are nearly twice as high?'

The question remains whether to heat from a central plant, or to split up the estates into groups each served from its own plant. At one time the P.H.A. strongly favoured the group system, but further experience has shown that although grouping has the advantage of lower capital costs, the operating costs are considerably higher and outweigh the initial advantage.

Part 4 of the report deals with technical information. If the whole house instead of the single room is recognized as the unit for space heating, it becomes more than ever necessary to reduce heat losses from the structure, and in America great care is taken to see that doors and windows fit properly, weather-stripping being generally adopted. Double windows are not in general use. The standard of structural insulation rests on an economic balance between the costs of material and insulation on one hand and that of fuel on the other. In 1947 the Federal authorities raised their requirements for structural insulation, because of increases in the price of fuel. Examples of typical construction are given, and in the opinion of the mission it would be folly to embark on a scheme of district heating in Great Britain without incorporating the highest standards of structural insulation.

Steam is the traditional means of heating in America and therefore held first place when district heating was contemplated. To the American engineers it possesses advantages, especially when applied to commercial centres, as a single and comparatively small main can be used, since it is not the usual practice to return condensate; but in self-contained housing estates those considerations are less important, as on a new site there would not be a congestion of existing underground pipes and cables to make a large-sized main difficult to install, and in the more recent estates hot water has been chosen as the medium; indeed, the mission gathered the impression that hot water was gaining in popularity for heating purposes, quite apart from district schemes, although it was not easy to find the reasons for this tendency. Still, the force of tradition is strong and steam has been the choice for the majority of housing estates served by district heating. In most of such schemes the two-pipe system has been employed.

The American argument that steam is cheaper and easier to transmit through congested districts than hot water impressed the mission; it is a point to be remembered when considering plans for the rebuilding of war-destroyed city centres.

Chapter 26 deals with distribution mains and contains drawings of different forms of construction. In America the underground concrete conduit is not made with removable covers, as long experience has convinced American engineers that a homogeneous construction with tight joints and permanent waterproofing is of much greater importance than accessibility.

On the general question of fuel the report states that there does not seem to be any aspect of the coal supply position that favours district heating in America in comparison with Great Britain. Prices vary greatly from place to place but are generally lower than in this country. The greater use of oil in America does not seem to be a major factor affecting the decision whether to use district heating or not.

The report includes several appendices and tables giving statistical information, and 32 plates illustrate the types of towns and dwellings served. The aim of the mission was to present a factual account of existing schemes in the U.S.A. and to assemble in one document all possible relevant data, leaving it to others to form their own conclusions on the merits of such schemes in their relevance to conditions in the United Kingdom.

The members of the mission were: W. A. MacFarlane, B.A., B.Sc., Ph.D., M.Inst.F. (Ministry of Fuel and Power); Richard Eve, B.Arch., [*A*], (B.R.S.); G. Nelson Haden, O.B.E., B.Sc., M.I.Mech.E., P.P.I.H.V.E. (G. N. Haden and Sons); A. C. Pallot, M.B.E., B.Sc.(Eng.), M.I.C.E., M.I.H.V.E. (Ministry of Works); S. Pointon Taylor, O.B.E., M.T.P.I. [*F*], (Ministry of Health); and Donald V. H. Smith, M.Inst.F., M.I.E.S., M.I.H.V.E. (Donald Smith, Seymour and Rooley).

The Special Report is published by H.M.S.O., price 4*s*. 6*d*. net.

Anti-fungus Solutions. When asked to suggest a preservative against wood fungal decay the average architect would rattle off one or two trade names at once, but if pressed to say what he really knew of their effectiveness he might be at a loss, except for the rather weak reply that since the firms had been in existence for many years their products cannot be useless, otherwise they would have been driven out of existence. It is therefore useful to learn that Messrs. Brooke, Boulton and Evans (Pestcure Ltd.) have issued a F.P.R.L. report on their P.C.L. dry rot solution No. 2, after careful tests carried out in accordance with the method laid down in B.S. No. 838, 1939.

Four blocks of Scots pinewood sapwood were tested against each of four fungi: lentinus lepideus, which likes telegraph poles and railway sleepers; coniophora cerebella (a scientific colloquialism for the cellar fungus); poria vaporaria, one of the fungi responsible for decay of softwoods in buildings and coal mines; and polystictus versicolor, the most important fungus causing decay of hardwood timber out-of-doors in this country. The solution was found to be extremely toxic to wood-destroying fungi, and blocks dipped in the full-strength preservative for 10 seconds were entirely protected from attack; thus the solution conforms to the requirements of B.S. No. 1282:1945.

The solution was also tested as a fungicide against dry rot; six blocks of sitka spruce were sterilized and then inoculated with dry rot. After nine months in culture four blocks were given one coating of P.C.L. applied by brush, and two were brushed with tap water so as to act as controls; after drying, two of the treated blocks were given a second brushed coating. After a further six weeks incubation there was no further growth on the once-brushed blocks, and none at all on the twice-brushed, whereas growth continued on the control blocks. Thus even one coating is enough to prevent the outgrowth of dry rot from sitka spruce blocks under the conditions of test.

Gas Handbooks. The British Gas Council have issued two handbooks dealing with the installation and utilization of gas for domestic purposes. The first is *Domestic Gas Handbook for Architects and Builders*, drafted by specialists following study of the findings of the Egerton and Simon Committees. Section 1 deals with fuel services in the home, and summarizes the Egerton and Simon reports. It is estimated that in Great Britain there are some 13 million families of whom over 10 million are gas consumers and 8 million electricity consumers; the majority use gas for cooking, and it is predicted that an increasing use will be made of gas in replacement of solid fuel. Experience shows that the equivalent of 600 therms of gas is ample to give adequate service to a family of four in the normal small house of about 1,000 sq. ft. of floor space. Where gas and coke are used in such a house they are supplied by 4 tons of coal, although, of course, these figures are not applicable to each and every case.

Section 2 is on gas supply, and gives information about the installation of mains and service pipes, adequacy and constancy of supply and protection of pipes; it also calls attention to the importance of early consultations between architects, building contractors and representatives of all the services.

Section 3 deals with the ventilation of dwellings, and gives drawings of flue construction, and of good and bad positions for terminals on flat and sloping roofs. Minimum standards of ventilation are quoted, and the problem of condensation in flues is considered.

In Section 4, space heating, illustrations show typical examples of gas-fired heating appliances, including auxiliary heaters and coke-fired stoves. It is noted that the Code of Functional Requirements proposes that higher standards of heating be employed in low-cost houses than has been the practice in the past, and figures are given for the annual consumption of fuel needed to attain those standards.

Water heating is discussed in Section 5, which gives diagrams of pipe runs for various installations. Sections 6, 7, 8, 9 and 10 deal with cooking, refrigeration, laundry, central heating and built-in appliances respectively.

Section 11 gives new standards of fuel service, with illustrations of typical house plans on which recommended runs and sizes of service pipes are shown; there is also a diagram of a heat service unit. A table gives the estimated annual consumption of gas and coke (in the South of England) for the appliances in the various rooms of a house, set out in terms of therms, tons of coke, and the corresponding amount of coal needed to provide them. A glossary ends the book.

A companion book is volume 1 of *Codes of Practice* for gas installations, in which are bound together the ten codes, for single family dwellings, to which the Ministry of Works urged that priority should be given.

The *Domestic Gas Handbook* is priced 20*s*., and the *Codes of Practice* 15*s*.; obtainable from the British Gas Council, 1 Grosvenor Place, London, S.W.1.

Practice Notes

Edited by Charles Woodward [*A*]

L.C.C. DRAFT DEVELOPMENT PLAN. The L.C.C. at its meeting on 28 June approved the Draft Development Plan prepared by the Town Planning Committee. The following provisions of the plan are reproduced here by the courtesy of the L.C.C.

For estimating the amount of land required for various non-residential purposes, floor space indices are to be determined by calculating the maximum ratio between total floor areas and the gross site area, including half the surrounding streets.

For individual sites in non-residential areas the aggregate floor area of the building is to have a ratio to the *net site area* as follows: 5 : 1 central core of dense development, 3½ : 1 sub-central areas, 3 : 1 principal suburban areas, 2½ : 1 smaller suburban areas, 2 : 1 remainder of the county.

Gross floor area is to be measured at each floor level above and below ground, and includes thicknesses of internal and external walls, areas of staircases, corridors and covered passages, lavatories and other private accommodation enclosed or covered by the building. Basements used for offices, living or similar accommodation are to be included, but underground private garages and space for loading or unloading, bank vaults, strong rooms and safe deposits, storage and similar purposes are excluded; electricity sub-stations and similar exceptional uses are also excluded.

Net site area is measured for the actual curtilage, excluding roads or public ways.

For twelve months the Ministry of Town and Country Planning Daylighting Code is to be used on all residential or other development applications so as to ascertain whether it is a satisfactory method of controlling daylighting to buildings.

For non-residential buildings angular set back lines are as follows:

Zone	*Enclosed Courtyards*	*Elsewhere*
5 : 1	45 degrees	56 degrees
3½ : 1	45 ,,	51 ,,
3 : 1	45 ,,	45 ,,
2½ : 1	45 ,,	45 ,,
2 : 1	40 ,,	40 ,,

Single-storey buildings up to 15 ft. high may project beyond the angular line, provided that in a residential zone they are outbuildings only. Where a site adjoins the boundary between two zones with different angles the lower angle shall be used on the side of the site facing the boundary between the zones. Where a courtyard, other than one used solely for sanitary accommodation or staircases, is enclosed by buildings of more than one storey on all sides, whether they are in the same curtilage or not, the angular set back is to be 45 degrees and 40 degrees in the 2 : 1 zone.

R.I.B.A. STANDARD FORM OF BUILDING CONTRACT. Practice Notes Nos. 9-18 issued by the Joint Contracts Tribunal Representing the R.I.B.A., the R.I.C.S. and the N.F.B.T.E.

Practice Note (9). The Tribunal considered whether Clause 5 (*c*) of the R.I.B.A. 1948 Standard Form of Contract contemplated and gave the architect the right to order the test of a floor *in situ*, and generally whether the testing referred to in that clause extended to the testing of executed work. The Tribunal were of the opinion that Clause 5 contemplated tests of cement or concrete cubes or unfixed materials only, and did not cover the testing of materials when built into the job.

Practice Note (10). The Tribunal expressed the following opinions in regard to the effect of incentive schemes upon contracts:

(*a*) The Tribunal endorsed the opinion given by the Clerk to the National Joint Council that para. 1 (i) of the Summary of Settlement Regarding Incentives and Wages, etc. of 20 October 1947, issued by the National Joint Council for the Building Industry means that before each task covered by a scheme starts to operate on a site or job the target and bonus payments must be fixed by the employer and agreed with the employees concerned in the carrying out of the task. 'Beforehand' in this paragraph does not mean before entering into a contract.

(*b*) It was agreed that in prime cost plus profit or fixed fee contracts the adoption

of a scheme of incentives was at the option of the building owner because the building owner had the right to decide what expenses should be incurred.
(*c*) It was agreed that in lump sum contracts the contractor could initiate an incentive scheme without reference to the building owner, but he was not entitled to claim any addition to the contract sum on that account.
Practice Note (11). The opinion of the Tribunal was asked regarding practice in the matter of the remeasurement of items in the Bills of Quantities not marked 'provisional'.

The following extract from Clause 10 of the R.I.B.A. 1948 Standard Form of Contract was noted: Any error in description or in quantity in or omission of items from the Bills of Quantities shall not vitiate this contract but shall be rectified and treated as a variation.

It was agreed therefore that both parties had the right to require the remeasurement of any items, but that in practice such right would be exercised reasonably. The opinion was accordingly expressed:
(*a*) that both the Quantity Surveyor and the Contractor had the right to insist on a remeasurement of items and/or sections of a Bill of Quantities not marked 'provisional'.
(*b*) where items or sections were marked 'provisional' they must be remeasured in any case.
Practice Note (12). The Tribunal considered the practice reported to them by Licensing Officers of borrowing the Priced Bills of Quantities before issuing a Building Licence.

It was agreed that the Priced Bills of Quantities were confidential and should not be disclosed to the Licensing Officer without the consent of the Contractor. In order that the Licensing Officer might be informed of the extent of the work it was suggested either that a blank Bill of Quantities might be furnished or an invitation extended to the Officer to inspect the bills at the architect's office.
Practice Note (13). It was the opinion of the Tribunal that, where a basic price for timber had been inserted in the list attached to the Bills of Quantities, adjustment for variation of cost should be made in respect of timber used in formwork. This opinion was reached on the ground that timber used in formwork should be regarded as consumable stores and not by way of plant. In ascertaining the amount of the adjustment account would be taken of the value of timber salvaged by the contractor. The Tribunal appreciated the difficulties which would arise if materials not incorporated in the work but used by way of plant were held to be subject to the fluctuation provisions.
Practice Note (14). The Tribunal were invited to recommend that timber should be described in Bills of Quantities or Specification as 'best quality timber obtainable under licence'. The Tribunal called attention to the terms of Clause 5 of the R.I.B.A. 1948 Standard Form of Contract which provides for the supply of material as described in the Bills of Quantities 'so far as procurable'.
Practice Note (15). The Tribunal was of the opinion that:
(1) Where an article subject to purchase tax was the subject of a p.c. sum under Clause 22, 'the net cost to be defrayed' by the Contractor was the cost plus purchase tax and from that amount 5 per cent cash discount was deductable.
(2) Where the article subject to purchase tax was specified in the list attached to the Bills of Quantities under Clause 25A(2) and the basic price of that article was increased by reason of an addition of purchase tax, the amount of such addition was reimbursable net to the Contractor.
Practice Note (16). In regard to dayworks carried out under Clause 9(*c*) of the R.I.B.A. 1948 Standard Form of Contract the Tribunal was of opinion that the Contractor was entitled to be paid for profit and overheads on the actual cost of wages in dayworks at the time the work was done, unless the Bills of Quantities otherwise provided.
Practice Note (17). The Tribunal were invited to consider whether, and if so in what circumstances, any reduction in the rate of premium for Employers' Liability Insurance due to the abolition of Workmen's Compensation Insurance, should be set off against the increase in statutory insurance contributions provided for under the National Insurance Acts where, in accordance with the views expressed in Practice Note 8, that increase was reimbursable to the Contractor.

It was the opinion of the Tribunal that where reimbursement of the increase in statutory insurance was *ex gratia*, any saving might properly be taken into account in calculating the payment to be made to the Contractor, but if the payment of increases in statutory insurance contributions was contractual, then there was no justification for any set off. It was noted, however, that the amount of the saving due to the abolition of Workmen's Compensation Insurance would depend upon the individual circumstances of each contractor.
Practice Note (18). The Tribunal were of the opinion that the Priced Bills of Quantities remain the property of the Contractor and that the payment of a deposit for obtaining the tender documents did not alter this position.
Note: *Practice Notes Nos.* 1 *to* 8 *will be found in the R.I.B.A.* JOURNALS *for October* 1946, *p.* 565*;* 13 *January* 1947, *p.* 189*; April* 1947, *p.* 334*; December* 1947, *p.* 85*; July* 1948, *p.* 418.

MINISTRY OF HEALTH. Circular 67/49, dated 30 June 1949, addressed to all Housing Authorities in England, refers to the new Order which defines the amount of money that may be spent on property without a licence between 1 July 1949 and 30 June 1950. (Control of Building Operations (No. 13) Order, 1949, S.R. & O. 1949, No. 1102.)

The Circular also refers to the case of J. Dennis and Co., Ltd. *v.* Munn (quoted in Practice Notes for April 1949), which decided that the free allowance may not be used to cover additional cost of work for which a separate licence has been issued or to cover work additional to but inseparable from work for which a separate licence has been issued. Only if the work is severable, ordered separately, and executed separately from work already *licensed* is the free allowance available.

In no circumstances should the local authority deduct the value of the free allowance in arriving at the amount of the licence for a 'particular work' as such action may result in work being carried out illegally.

If a licence is to be granted it should relate both in its terms and in the limit of cost to all of the work which the local authority considers essential.

The Circular states that a few cases have occurred where some delay appears to have taken place in the investigation by local authorities of infringements of Defence Regulation 56A, with the result that they have become out of time for summary proceedings, and the cases have had to be referred to the Ministry of Works for submission to the Director of Public Prosecutions.

In deciding whether a case is suitable for proceedings on indictment the Director is influenced by whether the extra expense to the defendants of such proceedings can be attributed to delay on the part of the authorities concerned with the administration of the Regulation and for which they might be adversely criticized by the court. It is therefore hoped that local authorities will ensure that all enquiries into suspected breaches of the Regulation are carried out as speedily as possible.

Circular 68/49, dated 30 June 1949, states that contributions of the amounts specified in the Housing (Financial and Miscellaneous Provisions) Act, 1946, will be payable in respect of new houses completed before 30 June 1950.

In notes on Building Materials and Components dated July 1949 it is stated that, in future, although large slates are not yet readily obtainable everywhere, the supply situation will permit roofing slates to be specified irrespective of size for all types of work both for repairs to existing roofs and for new house building.

MINISTRY OF TOWN AND COUNTRY PLANNING. The Ministry has now issued a series of documents explaining to local planning authorities how they should prepare development plans for their areas for submission to the Minister by 1 July 1951. These documents are Circulars Nos. 40, 59, 63 and 70, obtainable at H.M. Stationery Office

The Ministry stress the need to secure maximum public co-operation and approval of the proposed development plan as its purpose is above all to reflect the wishes of the people living in the area. Continual consultation and discussion are called for, and planning authorities are recommended to make their proposals as widely known as possible by exhibitions of maps and models at various centres. In any case there is a statutory obligation to exhibit plans publicly for not less than six

weeks after they have been submitted to the Minister in order that there may be an opportunity for making objections.

The Ministry have now issued Bulletin of Selected Appeal Decisions, No. 5, dated March 1949. It is obtainable at H.M. Stationery Office, price 6*d.* net.

The Central Land Board state that the answers given on many S.1. claim forms are insufficient for development value to be assessed. The Board will, therefore, ask for such further information as they may require, and unless claimants reply promptly with the Board's requests it may be that the claims will have to be rejected. The Board's requests will not provide an opportunity for claimants to amend or vary claims, but merely to give further particulars.

The Ministry have issued a booklet, being 144 Questions and Answers in respect of the 1947 Town Planning Act. It is obtainable at H.M. Stationery Office, price 6*d.* net.

The Central Land Board in Circular C.L.B.24, dated 27 July 1949, refer to the publication of the Town and Country Planning (Minerals) Regulations, 1949. It is pointed out that these Regulations require affirmative approval of both Houses of Parliament, but that they cannot be submitted until October. Meantime, when preparing claims in respect of minerals to which the extended time-limit (31 December 1949) applies, claimants are advised to take the Regulations into account and to formulate their claims accordingly. The Regulations can be obtained at H.M. Stationery Office, price 1*d.*

The Minister has now made the Town and Country Planning (Isles of Scilly) Order, 1949, S.I. 1949, No. 1321, which provides for the application of the Town and Country Planning Act, 1947, to the Isles of Scilly as if those Isles were a separate country. The Order came into operation on 1 August 1949, and is obtainable at H.M. Stationery Office, price 1*d.*

In Circular No. 9 49, dated 9 July 1949, the Central Land Board states that the assessment of development charge on all local authority developments will be on the basis of the formula set out in Paper 1 attached to the Circular, to which that formula applies. It is essential for the successful trial of the working of the formula that it should be used in the case of all developments to which it applies. If any local authority tells the Board that it does not want the formula to be used, or when any local authority withdraws from the arrangement, the Board will assess all developments carried out by that authority on an individual basis as if the authority was any other private developer. The Board cannot agree to the use of the formula in some cases only and not in others.

MINISTRY OF WORKS. The Scottish Association of Manufacturing Coppersmiths has made a further reduction of 4 per cent in the maximum selling price of copper cylinders and boilers with effect from 23 June 1949. The previous reduction of 4 per cent took place on 6 June (M.O.W./77/49. P.I.73. 29 June 1949.)

ACCEPTANCE OF TENDERS. It has been represented that it would assist contractors in the arrangement of their business if they were advised when their tenders have proved unsuccessful. The Association of Municipal Corporations is printing a recommendation in its journal that a general form of notification be issued to contractors concerned as soon as an acceptance of a tender has been approved.

The same considerations would appear to apply to tenders received in private practice, and a similar notification made to the contractors tendering would enable them to arrange their programme of work.

NATIONAL HOUSE-BUILDERS REGISTRATION COUNCIL. The Council has issued a revised Specification for Building Construction, which includes heat and sound insulation, and houses built for sale in accordance with the specification are certified by the Council accordingly.

The National House-Builders Registration Council has recently received statutory recognition, and it is concerned to ensure that houses built by private enterprise for sale are properly constructed.

The specification for houses and flats can be obtained from the offices of the Council, 82 New Cavendish Street, London, W.1, price 5*s.* in a paper cover, and 6*s.* 6*d.* in a board cover.

LAW CASE. The following case appeared in the SCOTS LAW TIMES for 21 May 1949, and is reproduced here by the courtesy of of the editor of that journal.

Negligence—Professional Skill—Duty of Surveyor Reporting on Condition of Heritable Property—Dry-rot. The owner and occupier of a house which he had purchased in November 1945 brought an action of damages against a firm of surveyors who had been asked to inspect the property and report upon it before it was purchased. At the date of the purchase the property was in the occupation of the War Department and was not formally derequisitioned until 27 March 1946. On 1 May 1946 dry-rot was discovered which was subsequently eradicated at the expense of the War Department. The pursuer's claim was based on the alleged negligence of the defenders in failing to discover the presence of dry-rot at the time of their inspection, and the sum claimed as damages was made up of alleged out-of-pocket expenses incurred by the pursuer through not having occupancy of the house between May 1946 and February 1947.

Of consent, proof before answer was allowed. The evidence established that the pursuer, when contemplating the purchase of the house, requested his solicitor to deal with the matter as one of urgency as a number of prospective purchasers were in view. In these circumstances the defenders were instructed verbally to inspect the property and report upon it verbally the same day in order that the solicitor might put in an offer. A verbal report to the effect that the house was in good order was accordingly made, and the proposed offer was made and accepted. The evidence established that the house was good value for the price paid.

In finding that negligence on the part of the defenders had not been established, and granting decree of *absolvitor*, Lord Birnam said:

'It seems to me that the duty of a surveyor is not always the same, but must depend upon circumstances and upon the purpose for which he is asked to report upon a particular property. If either an architect or a surveyor were asked to examine a house with a view to ascertaining whether it is free from dry-rot, his examination would necessarily be much more lengthy and meticulous than if he were merely asked to report upon the general condition and value of the property, having regard to its locality, construction, accommodation and general state of repair. In the present case there can be no doubt that the instructions given to the defenders were of the latter kind. The house was furnished and occupied, and the time at the disposal of the defenders before making their verbal report was extremely short. Even so, the evidence is, and I accept it, that the possibility of dry-rot is a thing that ought always to be present to the mind of a surveyor, and he should be on the look-out for any evidence that might to his skilled mind be suggestive of dry-rot; but I am unable to accept the view that in such circumstances his duty requires him in the absence of any suspicious circumstances to cause carpets and linoleums to be lifted and to go underneath floors and make a detailed examination of every hidden corner of the building. In my judgment, therefore, there was no duty on the defenders in the circumstances of the present case to go under the floor, especially as Mr. Allan was unaware that there were certain loose boards in a press under the stair by which he could have got access to the space underneath. It is not without significance that, although a detailed examination of the house was made both at the "marching-in" and "marching-out" of the military authorities, no mention is made in either report of the loose boards in the press under the stair. Nor does it seem to have occurred to any of those who took part in these inspections that they should have examined the under-floor condition of the house.

'Even if I should be mistaken in the conclusion which I have expressed regarding the defenders' duty in this matter, it was not proved that the dry-rot which was manifest in May 1946 would have been visible to the defenders in November 1945 even if they had gone below the floor. The evidence of the skilled witnesses was unanimous to the effect that dry-rot spreads very rapidly in a house that is unoccupied and unventilated, and while certain of them expressed the view that the dry-rot must have been far enough advanced in November 1945 to be visible to anyone making an under-floor inspection, this was not proved as a fact.'

Ker v. *John H. Allan & Sons*, Outer House, Lord Birnam, 4 May 1949.

Correspondence

HOUSING LAYOUTS—FENCING

Sir,—May I draw the attention of our members to what, in my view, is a most vital matter in the designing and carrying out of housing layouts (in fact, I refer to any dwelling where young children are concerned).

It appears, for æsthetic reason, some architects advocate the omission of fences, etc., to the fronts of houses, but personally I am convinced that this is a case where amenity should take second place to safety. I understand cases of fatal accidents have occurred where no provision has been made to prevent children running out from front gardens on to the roads.

The planting of privet hedges should, in my view, be discouraged, but there are other varieties of planting which produce pleasant results. Nevertheless, I favour the building of dwarf walls, and the provision of gates.

It may be argued that in planning the layout, dwellings should be sited so as not to front on to roads carrying wheeled traffic, but I doubt whether in actual practice this can be achieved up to 100 per cent.

I, therefore, make a plea to my fellow architects to view this matter with the gravity it demands.—Yours faithfully,

J. NELSON MEREDITH [*F*]
City Architect, Bristol

Book Reviews

Town and Country Planning, by *Martin S. Briggs* (County College books.) 7½ in. 80 pp. text, plans. Geo. Allen and Unwin, 1948. 6*s*.

Mr. Martin Briggs always writes in a most attractive way which is both pleasant and informative, especially to the lay reader. This straightforward little book with its clear drawings by the author provides a useful introduction for the general reader rather than the technician. It contains only 80 pages and can be read from cover to cover in a 50-mile railway journey.

From many indications in the text it appears to have been written a couple of years ago and already the many developments which have taken place both in the law and practice tend to render some at least of the information rather out of date.

Is town planning a lost art or a new science? Every generation has contributed something both to town and country whether it was a conscious effort or not. In these latter days it is very conscious and very much of an effort. No longer is it a subject for the dilettante, or the amateur.

To many architects it looks almost as if 'control and not construction' has become the order of the day.

Towns built with an ideal are not always ideal towns from the point of view of the inhabitants, even when their creator has been a well meaning autocrat like the grand dukes or the great industrialists of the past. Ebenezer Howard, in our generation, has done more than any other to point the way to the essentials of a self contained community. The garden cities of Letchworth and Welwyn are still uncompleted, but now that one has been nationalized and the other left, we can only hope that the ideals for which Howard strove will not be forgotten.

The replanning of our existing towns presents by far the biggest problem and here the greatest opportunity exists for providing something far better than we had before, but the procedure is slow and the difficulties immense.

Communities and precincts, Industry and Transport, are touched upon in a general but enlightening manner, but full of interest to the ordinary reader for whom the book is intended.

The chapters on Open Spaces and Country Planning and Preservation give an excellent summary of the general principles on which this side of planning should be based.

The final chapter on ways and means rightly emphasizes that 'planning pays; it aims to eliminate waste and to secure the most economical use of labour, land and material resources.'

The book has yet to be written, however, which will solve in black and white the difficulties which confront the new Ministry of Town and Country Planning and also the practising architect, in their valiant efforts to secure abiding results, amid a welter of government departments, and economic restrictions. W. R. DAVIDGE [*F*]

The Land of Italy, by *Jasper More*. (Books on the countries of Europe *series*.) 8½ in. viii + 264 pp. + pls. + endpaper maps. Batsford. 1949. 18*s*.

The Land of Italy is likely to be most appreciated by the prospective visitor to Italy, largely for whose benefit Mr. More has arranged his plan of writing. He commences with a review of the northern routes of entry, describing the pros and cons of each Alpine pass in clockwise rotation, before proceeding with methodical thoroughness to zig-zag southwards with his descriptions until he says farewell to the reader mentally abandoned on the eruptive cone of Etna, 'during the first few moments which precede the dawn'. An intention to omit no town nor village with any artistic possession favours the tourist but leads inevitably, in a single medium-sized volume, to a 'cataloguing' which will probably prove wearisome to the average reader for pleasure, who may regret an absence of personal anecdotes and colourful passages.

In a book concerned with many aspects of the country and arranged according to geographical progression, architectural information is of necessity abbreviated and widely scattered. For the architectural student, whatever loss there is in this direction is compensated for by opportunities to perceive his buildings within their topographical settings, and the historical background throughout makes it for him a good companion to the more specialized works.

Mr. More usually comments unfavourably upon Italian architecture of the past three decades. The picture is, however, incomplete, for example there are two references to, and a photograph of, the Milan Railway Station, while the later and more chastened design for the Florence Station is completely ignored, possibly because of ideological promptings.

There is an excellent collection of photographs, many of them of outstanding beauty, though surely something better could have been found for the colour pages, and it is regrettable that space within the book was not provided for the School of Canaletto painting which makes such an attractive dust jacket.

ALEXANDER POTTER [*A*]

London Housing. A comprehensive survey of the post-war work of the London County Council, *cover title*. Building, *journal*. (By *Walter Segal*.) 11½ in. 63 pp. text illus. St. Margaret's Technical Press. 1949. 10*s*.

A reprint of three articles by Walter Segal on the L.C.C's. post-war work that recently appeared in the monthly journal BUILDING.

Graining and Marbling, by *John P. Parry*. 9¾ in. xi + 91 pp. + front. + xviii + 4 pls. Crosby Lockwood. 1949. 18*s*.

Probably more crimes have been committed in the name of this ancient craft than in any other. In an attractively produced book the scope of the grainer's work is here clearly defined, and those who consider that graining is an admissible practice will now have some grounds for hoping that it will produce fewer blunders. J.C.P.

The Medieval Churches of Cyprus, by *Robert B. Francis*. (Ecclesiological Society: Trans., N.S., vol. 2, pt. 1.) 8½ in. 63 pp. + folding map. text illus. (London.) 1948 (1949). 10*s*. 6*d*.

This booklet, crystallizing a lecture to the Society some years ago, gives much information in historical order under the headings 'Early Christian', 'Byzantine' and 'Latin' eras, the last corresponding to the western Romanesque and Gothic. It is accompanied by a useful chronological chart and a bibliography, and illustrated by a map, plans (from the R.I.B.A. *Transactions*, 1882-83) and photographs. There is an index of places. H.V.M.R.

The House for You. To build, buy, or rent, by *Catherine* and *Harold R. Sleeper*. Illus. by *H. Diamond* and *L. C. Jones*. 10½ in. xii + 313 pp. text illus. New York: John Wiley; London: Chapman and Hall. 1948. £1 10*s*.

This book has been written by a successful American architect and his wife to initiate the layman into the problems and hazards of building a house. It is full of information, not all of which is appropriate to this country. Earnest English readers may find its button-bright popular style a little trying, and on the whole it is perhaps the kind of publication that will feel more at home in its native land than abroad.

J.C.P.

The Technique of Building, by *E. G. Warland.* $8\frac{3}{4}$ in. xvi + 367 pp. text illus. Hodder and Stoughton. 1949. £1 1*s.*

This is another book on building construction, which takes the form of a series of very well drawn details illustrative of typical pre-war practice. It shows 'how' things are done without discussing 'why'. It suffers from the inevitable defect of such treatment in that the number of ways of detailing buildings is infinite, and the number of methods which can be shown is very limited. Some criticism must be made of the choice of some of the methods illustrated. A lot of water has run under our bridges since 1938. To look at many of the details induces a nostalgia for the old days of plenty: liberal timber, liberal lead, tons of steel and no labour problems. It may be argued that the good times will return—perhaps they will—but it is not a safe bet. If they do not the student of building construction who bases his knowledge on this and similar works is in for a rude awakening.

The notes on technique which accompany the drawings are scanty and in many cases ill chosen. For example, the only plaster mix described in the plaster section is a fat lime undercoat or a cement gauged hydrated lime undercoat where 'rapid setting' is required. This is much too meagre for a work which claims to cover building technique. The chapter on fire-resisting construction makes no mention of the British Standards, British Codes or the recent reports which together comprise the whole essence of fire-resistant construction.

No mention is made of Codes of Practice in the whole of the book.

R. FITZMAURICE [*Hon. A*]

Hepplewhite Furniture Designs, from *The Cabinet-Maker and Upholsterer's Guide* 1794. With a preface by *Ralph Edwards.* $9\frac{3}{4}$ in. 12 pp. + 80 pls. London. Tiranti. 1947. 7*s.* 6*d.*

Chippendale Furniture Designs from *The Gentleman and Cabinet-Maker's Director* 1762. With a preface and descriptive notes by *R. W. Symonds.* Text in both French and English. $9\frac{3}{4}$ in. 24 pp. + 80 pls. London. Tiranti. 1948. 7*s.* 6*d.*

The Ornamental Design of Chippendale, from *The Gentleman and Cabinet-Maker's Director* 1762. With a preface by *R. W. Symonds.* Text in both French and English. $9\frac{3}{4}$ in. 24 pp. + 80 pls. London. Tiranti. 1949. 7*s.* 6*d.*

These are three companion volumes in an admirable and inexpensive set dealing with Georgian furniture which successfully contrive, in the words of Hepplewhite's preface, to 'unite elegance and utility, and blend the useful with the agreeable.' Each contains 80 plates selected respectively from the important 1794 edition of the *Cabinet-Maker and Upholsterer's Guide* and *The Gentleman and Cabinet-Maker's Director* of 1762. Mr. Ralph Edwards gracefully introduces Hepplewhite's designs and Mr. R. W. Symonds [*L*] contributes a brief biography of Thomas Chippendale in the first and an interesting essay on rococo and chinoiserie in England in the second Chippendale book.

J.C.P.

English History at a Glance. A chart designed by *H. A. Vetter* with a historical digest by *P. Dantry* and *E. Savage.* 14 in. 34 pp. London. Architectural Press. 1949. 8*s.* 6*d.*

Here is a first rate attempt to trace in outline the whole story of English achievement since the Conquest—to provide in fact much more than the usual record of kings, warriors and politicians. The latter are present, of course, but side by side with them are the scientists, composers, philosophers, writers, painters and architects who were their contemporaries. On a large coloured chart, which is the basis of the book, appear the names of those who have chiefly influenced the life of this country in many fields of activity. A text digest, illustrated by portraits and historical pictures, amplifies the visual evidence of the chart. There is a comprehensive bibliography to persuade readers to further study and, perhaps, to disarm the scoffer who does not believe that history can be learnt at a glance.

A Manual of Historic Ornament, by *Richard Glazier.* $9\frac{3}{4}$ in. 6th ed. (6) + 184 pp. + 23 pls. (6 coloured). London. Batsford. 1948. 15*s.*

The latest edition of a standard work of reference for students that first appeared half a century ago.

The Architecture of Denmark. $12\frac{1}{4}$ in. 59 pp. Text illus. London. Architectural Press. 1949. 12*s.* 6*d.*

Most of the contents of this book appeared in a special issue of the ARCHITECTURAL REVIEW in November 1948. A few further examples of important Danish buildings, however, have been added. There are chapters on gardens, furniture and wallpapers, as well as on architecture old and new.

A History of the English House, etc., by *Nathaniel Lloyd.* (Reprint, revised.) $12\frac{1}{4}$ in. ix + 487 pp. text illus. Architectural Press. 1931 (1949). £3 13*s.* 6*d.*

This is, of course, the standard work on the subject. It has been long out of print, and its reappearance is very welcome. No alterations or additions have been made to the original 1931 edition apart from the correction of a few minor errors.

Churches. Their plan and furnishing, by *Peter F. Anson.* Illustrations by the author. Revised and edited by the *Very Rev. Msgr. Thomas F. Croft-Fraser* and the *Rev. H.A. Reinhold.* 10 in. xx + 242 pp. Milwaukee. Bruce Publishing Co. 1948. $6.50.

The author, who is British, compiled this book during the war, believing that peace would see a revival of church building on a scale unknown for centuries. Government regulations and public indifference proved him wrong so far as Britain was concerned and his text, very slightly edited to divert its appeal to transatlantic readers, has now been published in America. It provides clergy and laity with a readable guide to the building and remodelling of Catholic churches and with a summary of the rules that govern their furnishing.

Design in Civil Architecture, Vol. I. Elevational treatments, by *A. E. Richardson* and *Hector O. Corfiato.* $12\frac{3}{4}$ in. 216 pp. Text illus. London. E.U.P. 32*s.* 6*d.*

The two professors have prepared a selection of elevations of notable buildings in various parts of the world to refresh the minds of architects. Each drawing is accompanied with a short paragraph of critical appraisal in English, French and Russian. The publishers deserve commendation for the high standard of production.

Landscape and Housing Development. A handbook prepared by the Bournville Village Trust. 10 in. 56 pp. Text illus. B. T. Batsford. 1949. 6*s.*

Half a century's practical experience in landscape architecture at the garden suburb of Bournville is summarized in this useful, well illustrated and documented handbook.

Water Treatment, etc., by *G. V. James.* 2nd ed. $9\frac{1}{2}$ in. xi + 247 pp. + front. + (xi) pls. text illus. Kingston Hill: Technical Press. 1949. £1 10*s.*

A new and revised edition of a book first published in 1940 based on a thesis by the author for his M.Sc. degree in the University of London. It is mainly addressed to chemists, engineers, firms engaged in water treatment, and to sanitary authorities.

Air Conditioning, by *Herbert* and *Harold Herkimer.* English reprint. $8\frac{1}{2}$ in. ix + 692 pp. text illus. Brooklyn, N.Y.: Chemical Publishing Co.; London: Chapman and Hall. 1947 (1949). £2.

Two experienced American engineers, father and son, provide detailed information and data on every phase of air conditioning, theoretical and practical.

Development Procedure under the Town and Country Planning Act, 1947. A Practical Guide, by *W. C. Graper.* $7\frac{3}{4}$ in. viii + 141 pp. Crosby Lockwood. 1949. 8*s.* 6*d.*

The author, an Area Planning Officer of the Hampshire County Council, has written a concise guide for architects and surveyors.

Citizens' Guide to the New Town and Country Planning, by *R. K. Kelsall.* $7\frac{3}{4}$ in. 94 pp. + (6) pls. Oxford: Pen-in-Hand. 1949. 5*s.*

A simple review of the subject more useful to the layman than to those actively concerned with details of planning.

Chicago Civic Center. *Chicago Plan Commission.* Ob. 9 in. × 12 in. 40 pp. incl. pls. Text illus. Chicago. 1949.

This booklet summarizes and illustrates the interesting proposals prepared by the Chicago Plan Commission for the city's new civic centre. It serves also as a reminder that Chicago made an extraordinary contribution to present architectural theory by the speed of its growth at the end of the last century. Her architects built in the simplest forms because there was no time for frills.

Works **Lavatories.** A Guide, etc. *Association for Planning and Regional Reconstruction and Industrial Welfare Society*. 9½ in. vi) + 81 pp. text illus. 1949. 12*s*. 6*d*.
An attractive guide, too, well produced and informative, designed for ready reference.

Modern Furniture and Fittings, by *John* and *Rodney Hooper*. With sections by *Geo. H. Chantrell* and *H. O. Cheeseman*. 9¾ in. xviii +327 pp. lxx + 4 pls. + 18 folding pls. Text illus. Batsford. 1948. £2 2*s*.
This book's name is misleading. Not 'Modern Furniture and Fittings' but 'Furniture and Fittings in Great Britain between the wars' would best describe it, and even that title would be too wide, for the book excludes from its very considerable scope nearly all seat furniture and nearly all cheap and medium priced furniture for quantity production. It thus gives us a panorama of designs for fairly expensive furniture at one particular place and time. So did the books of Chippendale, Hepplewhite and Sheraton. The comparison is not unfair, but it is unflattering to this book, not so much because there are some bad designs in it (for so there were in theirs), but because the best of the recent designs in this book will never set the world a standard, as the best in theirs did, and still do. Too many designs in this book tend either to copy the 18th century or to ignore it, Scylla or Charybdis, equally dangerous to life.

It is much to be hoped that the book, used as it will surely be in every school in the country, will not revive a dying fashion and will not be taken uncritically for a manual of design.

But this happily is not all the story. The greater and better part of the book is concerned with workshop practice and methods of construction—the best commercial practice, well described, and illustrated in 1,700 drawings and more. This is very valuable indeed. Here the 18th century is neither copied nor ignored: its methods are surpassed, or where they cannot be surpassed, are applied successfully, to new (albeit not worthy) forms of furniture.

DAVID W. PYE [A]

Notes and Notices

NOTICES

The R.I.B.A. telephone numbers
The R.I.B.A. telephone numbers are now LANgham 5721-7 (instead of WELbeck 5721-7).

The Rome Scholarship in Architecture, 1949
The Faculty of Architecture of the British School at Rome have awarded the Rome Scholarship in Architecture for 1949 to Mr. Ian Scott Melville [Student, R.I.B.A.], of the School of Architecture, University of Liverpool. Mr. Melville, who is 30, commenced his course at the Liverpool School of Architecture in 1937. After six years of war service his studies were resumed in 1945.

The Rome Scholarship in Architecture is provided for by an annual grant made to the British School at Rome by the Council of the Royal Institute of British Architects, and is normally tenable for two years, but may be prolonged in exceptional cases for a third year.

The Faculty of Architecture considered that all four schemes submitted this year had achieved an adequate architectural solution of the problem set. This was partly due to the programme, which is attractive, full of suggestion to the imaginative designer, and much simpler than many of those set in previous years. The Faculty were unanimous in deciding that Mr. Melville's design is thorough, sensitive and consistent, and admirably suits its site.

The plan is simple in its main features and subtle in detail; the swimming bath is uncrowded and the services well placed. The set of drawings is charmingly presented and, although incompletely rendered, is the only set which can be clearly read.

The design by 'Lamech', following an excellent *esquisse*, is less happy in the placing of the swimming and diving pools, and in the internal planning of the restaurant. The scheme has solid merits which are not, however, sufficiently supported by the detail. The set of drawings by 'Capriccio', apart from a slight improvement on the *esquisse*, is somewhat under-developed. The plan is simple and could be effectively worked up; but the elevations and the modelling of the terrain are a little weak. The Faculty had the impression that the designer was not yet familiar with every feature of his site. 'Marathon' came very near being disqualified by a considerable departure from his *esquisse*. The Faculty felt, however, that despite attendant difficulties of service, the bringing forward of the circular restaurant provided a fine vantage point for views on all sides, and that this alteration could be accepted. The design is an interesting one, and in many respects courageous. It falls short of 'Florence's' design in being less finished, less simple, and consequently less easy to appreciate as a unified plan and composition.

Amendment to the Bye-laws: By order of the Privy Council dated 14 July 1949, the following variation in the Bye-laws of the Royal Institute of British Architects has been approved:—
BYE-LAW 62 :
Delete Bye-law 62 and *substitute* a new Bye-law as follows:
'62: The election of the person proposed for submission to His Majesty as a fit recipient of the Royal Gold Medal shall be by resolution of the Council.'

BOARD OF ARCHITECTURAL EDUCATION

The R.I.B.A. Intermediate Examination, May 1949
The R.I.B.A. Intermediate Examination was held in London, Birmingham, Plymouth, Manchester, Leeds, Newcastle, Edinburgh and Belfast from 13 to 19 May 1949.

Of the 664 candidates examined, 263 passed and 401 were relegated. The successful candidates are as follows:

*Adams, Anthony
Alford, M. G.
*Anderson, B. J. R.
Anderson, Rosemary E. (Miss)
Armitage, K. B.
*Ashworth, Stanley
Attwood, J. M.
Baggott, M. J.
Bailie, C. R. J.
*Baker, B. A.
Ball, T. W.
Banwell, G. E.
Barlow, R. A.
*Barnes, C. C.
Bateman, G. F.
*Baxendale, Eric
Bayley, A. C.
*Beckett, A. G.
Bickerton, Lavender M. (Miss)
Bilton, G. K.
*Bond, G. A.
Bonfield, W. J.
Booth, David
*Boulting, K. F.
Bowman, Edward
Bradford, S. W.
Briggs, H. G.
*Brough, D. R.
Brown, Margaret (Miss)
Brown, Patrick
Buck, J. A.
Burden, P. J.
*Burgess, C. S.
Burnett, Desmond
Cannon, G. L.
Carter, B. B.
Chamberlain, N. J.
Chandler, A. S.
Chard, A. R.
Charlson, B. D.
Chellis, R. V.
Claridge, Margaret M. (Miss)
*Clark, C. B.
*Clark, S. F.
Clemo, H. R. H.
Cobley, A. R. M.
Colpoys-Johnson, G. C.
Cook, R. J.
Coombs, Annette P. M. (Miss)
*Cooper, E. C.
Corbett-Jones, W. M.
Cordin, R. E.
Corfield, J. L.
Cowley, D. E.
Crawford, Ronald
Crofts, V. W.
Cross, J. A.
*Davison, A. J.
*Davies, Ian
*Done, A. E.
Dransfield, Lydia (Mrs.)
Dray, S. D.
Drew, G. W.
Drew, Rowland
*Eckersall, Leslie
Edgar, Kenneth
Edleston, J. H.
Edmead, G. P.
Edwards, D. G.
Edwards, M. J. C.
Elliott, E. I. V.
Elliott, I. D.
Ellis, G. F.
Ellott, G. J.
*Emmett, Phyllis M. (Miss)
Evans, D. O.
Evans, S. F.
Fell, R. J.
Finnet, P. L.
Fiske, H. P.
Ford, J. F.
Fortlage, Catherine A. (Miss)
Fowler, N. J.
Furbisher, W. R.
*Gadd, F. J.
Garrett, Ruth H. (Miss)
*Gibson, Ronald P.
Gill, W. K.
Girling, A. F.
Gladstone, J. M. C.
*Goodman, A. J.
Gough, William
*Greenslade, R. J.
Grove, D. T.
Hadland, J. L.
*Harding, H. C. W.
Harrison, J. D.
*Hayes, G. A.
Henley, R. H.
*Henton, A. S.
*Hewett, P. J.
Hill, A. H.
Hodkinson, Gordon
Holgate, K. H.
Holmes, Mary G. (Miss)
Hook, J. L.
Hooper, J. C. W.
Hough, J. Y. V.
*House, G. F.
Huckstepp, M. J.
Hudson, F. S.
Hughes, Peter
*Hull, D. E.
*Hurley, H. M.
*Hutchings, V. J.
Hyde, J. A.
*Inman, J. K.
Ives, D. S.
Jackson, R. B.
Jago, K. D.
James, F. C.
Jameson, Gordon
Jarrett-Yaskey, J. R.
Jefcoate, D. R.
Jenkins, C. D.
Jennings, G. M.
Johnson, D. C.
*Jones, S. R.
Jupp, K. E. J. A.
Kay, Geoffrey
*Kemp, Edward
*Kershaw, Albert
Kilpatrick, P. J.
Kimmins, M. T. H.
King, P. L. W.
King, P. R.
Lawrence, D. B.
Leaning, J. D.
*Leckenby, John
Leigh, John
*Lewis, E. L.
Little, C. L.
Lloyd, John
Lomas, G. R. A.
Lowe, E. J.
McBride, J. C.
McCay, D. J.
McConnell, G. H.
McCulloch, Margaret (Miss)
McNay, D. A. B.
Magarshack, Ruth B. (Miss)
Martin, R. J.
*Meade, P. V.
*Meldrum, A. F.
Melesi, Leonard
Miatt, R. C.
Miller, R. H.
*Minchell, C. S.
*Mitchell, R. F.
Mobsby, K. S.
Moon, Patricia (Miss)
More, J. B.
Morgan, D. C.
Morris, Kenneth
*Mortimer, K. C.
Murphy, D. Y.
Naunton, M. W.

Newman, K. W.
*Newton, Kenneth
Niblock, John
Nursey, D. H. A.
Oldham, Kenneth
Olive, Dan
*Pack, K. J. W.
Paddock, J. A.
Parker, I. D.
*Parker, N. C. C.
Parkinson, G. A.
*Parry, E. C.
Paterson, D. J.
*Pattison, G. E.
Peach, Dorothy (Miss)
Pearce, J. R. F.
Pearce, R. C.
Pennell, G. R. J.
Perry, O. E.
Phillips, G. G.
*Phillips, Ronald
*Pilkington, J. B.
Piper, C. J.
Pitcher, Peter
Pollard, A. F.
Pollard, H. A.
*Poole, L. E. J.
Porter, L. R.
Priestley, Bryan
Pugh, H. W.
*Pye, K. G.
Rainbow, J. A. A.
Rathbone, D. T.
*Read, H. S.
Reed, H. H.
Rice, Anne K. (Miss)
Ritter, J. A.
*Roberts, E. N.
*Roberts, T. W.
*Ross, Alan
*Rosser, R. E.
*Rossiter, Rex
*Rowe, A. H.
Rubinstein, Arthur
Satterley, Ann H. (Miss)
Scott, David C.
Sherlock, J. B.
Simmonds, D. C.
*Singleton, G. A.
*Skipp, L. E.
Smith, James T.
Smith, John L.
Smith, Kenneth S.
*Smithers, F. G.
*Snellgrove, J. A.
*Speller, Dennis
*Stahl, N. E.
Stanley, R. F.
*Staughton, R. A.
Stephens, G. P.
Stephenson, Arthur
Stow, D. A.
Streatfield, M. J.
Swinson, A. H.
*Taylor, J. W.
*Teare, Frederick
Tennent, D. D.
Thomas, M. B. W.
Thomlinson, Peter
*Thompson, O. E.
Thomson, J. B.
*Thorndyke, A. E.
*Tilley, J. C.
Tomlinson, J. B.
Tomlinson, R. P.
*Tonge, C. V.
Treadwell, Geoffrey
Tucker, S. J.
Wall, P. J.
*Walton, D. W.
Ward, J. E.
Warren, J. C. C.
*Watson, George
Weall, C. V. G.
White, B. P. F.
White, G. P.
*White, Norman
Whitley, R. J.
Wigham, H. R.
Wilmot, J. E.
Wilson, A. D.
*Wilson, E. J.
Wood, Thelma H. (Miss)
*Woodhams, Leonard
Yearsley, Joan I. (Miss)
*Young, J. C. A.

*Subject to approval of History Thesis or Theses.

The following candidate has also completed his qualifications and has now passed the Intermediate Examination:
Uffindell, G. H.

R.I.B.A. Maintenance Scholarships in Architecture

The following Maintenance Scholarship has been awarded for the year 1949-50: An R.I.B.A. 4th and 5th Year Maintenance Scholarship of £60 per annum to Mr. Peter A. Martin, of Oadby, Leicester.

The Maintenance Scholarships previously awarded to the following candidates have been renewed: Mr. H. W. D. Burgess (Welsh School of Architecture: The Technical College, Cardiff—R.I.B.A. Houston Maintenance Scholarship of £125 per annum). Mr. J. M. Phillips (Bartlett School of Architecture: University of London—R.I.B.A. Houston Maintenance Scholarship of £125 per annum). Mr. D. N. Sutcliffe (Department of Architecture: The Northern Polytechnic, London—R.I.B.A. Houston Maintenance Scholarship of £125 per annum). Mr. J. B. Crowther (Welsh School of Architecture: The Technical College, Cardiff—R.I.B.A. Houston Maintenance Scholarship of £125 per annum). Mr. D. G. Potter (The Polytechnic, Regent Street, London—R.I.B.A. Houston Maintenance Scholarship of £125 per annum). Mr. M. E. Holt (Nottingham School of Architecture—R.I.B.A. Howe Green 4th and 5th year Maintenance Scholarship of £40 per annum). Mr. H. R. Brady (Bartlett School of Architecture, University of London—THE BUILDER Maintenance Scholarship of £68 per annum). Mr. A. B. King (Architectural Association School of Architecture—The Ralph Knott Memorial Maintenance Scholarship of £45 per annum).

ALLIED SOCIETIES

Changes in Officers and Addresses

Essex, Cambridge and Hertfordshire Society of Architects. President, Mr. L. J. Gomme [*L*], 9 Cranmer Road, Cambridge. *Chelmsford and District Chapter.* Chairman, Mr. K. D. Box [*A*], c/o County Architect, County Hall, Chelmsford, Essex. *Southend and District Chapter.* Hon. Secretary, Mr. D. R. Burles [*A*], 59 Exford Avenue, Westcliff-on-Sea, Essex.

Birmingham and Five Counties Architectural Association. Hon. Secretaries, Mr. R. A. Smeeton [*A*], 72 Newhall Street, Birmingham, 3, and Mr. J. S. Scott [*A*], 115 Colmore Row, Birmingham, 3.

Wessex Society of Architects. President, Mr. R. S. Redwood [*A*], 19 Woodland Road, Bristol, 8. Hon. Secretary, Mr. Kenneth Nealon [*A*], 154 Redland Road, Bristol, 6.

The South Wales Institute of Architects. President, Mr. Edwin Smith [*F*], Great Western Chambers, Neath. *Central Branch.* Chairman, Mr. C. L. Matthew [*A*], Welsh School of Architecture, Technical College, Cardiff. *Western Branch.* Chairman and Hon. Secretary, Mr. C. G. Tagholm [*F*], 47 Mansel Street, Swansea.

The Indian Institute of Architects. President, Mr. C. M. Master, M.A. [*F*], 34-38 Hamam Street, Fort, Bombay.

The West Yorkshire Society of Architects. Address of Hon. Secretary changed to 11 Cavendish Road, Leeds 1.

The Norfolk and Norwich Association of Architects. Hon. Secretary, Mr. C. J. Tomkins [*F*], City Hall, Norwich. Mr. Tomkins' duties carry also the Joint-Hon. Secretaryship of the East Anglian Society of Architects.

Royal Incorporation of Architects in Scotland. President, Mr. Lockhart W. Hutson, O.B.E. [*F*], 119 Cadzow Street, Hamilton, Lanarkshire.

A Students' Design Club

The Buckinghamshire Society of Architects has formed a design club for students who are not attending classes. It is intended that such students should meet together, see each other's work and hear criticisms of work submitted in answer to the problems set. The problems set will lead up to the standard required for the R.I.B.A. Intermediate and Final Examinations. There are to be three or four meetings a year, on Saturday afternoons, when new design subjects will be announced and criticisms of the work submitted made by a distinguished architect; three-hour sketch design problems will also be set to familiarize students with examination conditions. Prizes of books will be awarded annually for the best work in the two groups. The first meeting will be held towards the end of September in High Wycombe. Those wishing to be present should notify the Secretary of the Bucks Society, Mr. W. Leslie Jones, 87 High Street, Great Missenden, Bucks.

As a further effort to help students resident in Buckinghamshire or working in offices of members of the Society, a Summer Sketch Club is being held this year. Prizes are being offered for sketches and measured drawings.

GENERAL NOTES

Housing: A Social Service. By J. H. Forshaw—Correction

Illustrated on page 397 of the July JOURNAL the eight-storey flats for Finsbury Borough Council were attributed to B. Lubetkin, of Tecton. The firm of Tecton was dissolved in November 1948, and the design of these flats is the copyright of the four former partners who constituted Tecton. Since the dissolution of Tecton, Mr. B. Lubetkin and Mr. F. Skinner have been executive architects for the completion of the work on this scheme.

Research Scholarships in Architecture Available to Students of the Architectural Association School of Architecture

Imperial Chemical Industries Travelling Scholarship. The Imperial Chemical Industries Travelling Scholarship for 1949, value £250, has been awarded to Mr. Ian Grant of Kensington, London. This scholarship is for study and research in connection with the decoration of buildings.

The Building Centre Scholarship. The Building Centre Scholarship for 1949, value £100, has been awarded to Mr. Ronald H. Sims, of Enfield, Middlesex. This Scholarship is for research into the properties and architectural uses of building materials in Great Britain.

New Chief Architect to Boots

Mr. Colin St. C. R. Oakes, M.B.E., T.D. [*A*], has been appointed Chief Architect to Boots Pure Drug Company, Ltd. Mr. Oakes, a 1931 Rome Scholar, was twice mentioned in despatches in the recent war.

Announcing this appointment, Lord Trent, Chairman of Boots Pure Drug Company, Ltd., paid a tribute to Mr. Percy J. Bartlett [*F*], who has just relinquished the post of Chief Architect having been with the company since 1927. 'With creative skill,' says Lord Trent, 'Mr. Bartlett has combined sympathetically the needs of our business and the architectural requirements demanded by local sentiment and tradition. His personality and ability will long be remembered by such excellent architecture as is seen in Boots' branches at Canterbury, Jersey, New Bond Street, Cambridge, Sheffield, Colchester and Norwich—to name only a few of the shops which are such a credit to the company.'

R.I.B.A. Golfing Society

The Society held a week-end meeting at Brancaster, Norfolk, on 25 and 26 June. It was its first venture of the kind and turned out to be an unqualified success.

The venue for the meeting was suggested by the Society's President, Sir Giles Gilbert Scott, who is an old member and past Captain of the Royal West Norfolk Golf Club at Brancaster.

Sir Giles proved an admirable and entertaining guide to certain fortunate members on their drive to and from Norfolk.

The competition results were;

Saturday. The President's Prize.
Stapleford Competition. *Morning.* Winner: Harold Marsh, 31½ points.
Runner-up: W. R. F. Fisher, 30¾ points.
Afternoon. Three-ball Bogey Competition (an innovation owing to odd numbers). Won by Sir Giles Gilbert Scott, Pat Hickey, H. St. J. Harrison.
Sunday. The Captain's Cup. Winner: E. H. Firmin, 79—6=73.
Runner-up: Harold March, 84—10=74.

The week-end golf concluded with a friendly four-ball, and John Grey, the Captain, voiced

the sentiments of all by expressing thanks to the Secretary, Eric Firmin, for his efficient organization and suggesting that this must become an annual fixture.

Cricket—R.I.B.A. *v.* R.I.C.S.

A sterling victory was recorded on 10 July when the R.I.B.A. beat the R.I.C.S. by six wickets on a broiling day at Elstree, the ground being kindly lent for the occasion by the Architectural Association.

The R.I.C.S. won the toss and elected to bat on a bone-dry wicket, so the R.I.B.A. toiled nobly in the field for three hours while the R.I.C.S. compiled 144 runs. Great credit must be given to the R.I.B.A. bowlers for preventing a much higher score.

After a pleasantly sociable tea interval, the R.I.B.A. opened their innings quietly and passed the R.I.C.S. score somewhat surprisingly for the loss of four wickets, and a most enjoyable day ended with considerable quantities of beer and 'shop' in the pavilion.

The Score

R.I.C.S.: 144 (P. Bynoe 6 for 23).

R.I.B.A. 188 for 4 wickets (B. Smyth 82, D. Taylor 33, P. Bynoe 27).

Cricket—R.I.B.A. *v.* Blue Circle. Snaresbrook, 24 July 1949

The R.I.B.A. lost the toss and were sent in to bat. Two quick wickets justified the decision of the opposing captain, but Bynoe and Hammond then scored freely, taking the score to 161 before they were separated. The later R.I.B.A. batsmen lost their wickets in an attempt to score quickly, and the innings was declared closed at 217 after 2½ hours batting.

The Blue Circle had 2¼ hours in which to try for the runs, but after losing four wickets fairly soon were mainly concerned with avoiding defeat. Half an hour from time it looked as though they would be successful, as no further wickets had fallen, but once the main stand was broken the remaining wickets fell, the last during the last over of the game.

The R.I.B.A. side greatly enjoyed their narrow victory, the first against the Blue Circle, and are most appreciative of the hospitality extended by the Blue Circle Club.

Score

R.I.B.A.: 217 for 9 wickets declared
(P. Bynoe 122, L. H. Hammond 46.)

Blue Circle Sports Club: 118.
(P. Bynoe 4—27, E. Bedford 3—33.)

R.I.B.A. won by 99 runs.

Obituaries

Wilfred Lawson Carter [*L*], of Northampton died suddenly, aged 63, on 10 May. He was trained at Haslemere and commenced practice in Northampton about 1920. He designed shops, offices and warehouses for Messrs. Cleaver, Wood Street, Northampton, and was the architect of the factory for Messrs. Pearce (Northampton) Ltd. at Little Billing, Northampton, one of the leading leather works of the country, as well as domestic architecture in and around Northampton.

John Ford, J.P. [*A*]. The death has taken place on 27 May at Seaton, Devon, of John Ford [*A*].

Mr. Ford started his career by being articled to an Exeter architect, afterwards going to Barnsley for seven years under the municipality there, where he designed fever hospitals and other public buildings. Upon the death of his father, a prominent Branscombe landowner and lord of the manor there, Mr. Ford returned home to manage the estate and to set up in private practice in Seaton, Devon, where he designed shops, council cottages, the sea retaining-wall and domestic architecture in the Honiton district.

Mr. Ford was for some years a member of the Branscombe Parish Council, and represented his parish on the Honiton R.D.C., following his father in the same position. Between them they served local government for ninety years. Whilst at Branscombe he was also a school manager. He leaves a widow.

Arthur John Hayes [*L*]. By the death of A. J. Hayes at the age of 56, Cardiff in particular and South Wales in general has lost a well-known and respected member of the profession. He had a varied career, which commenced as a young man in the Merchant Service and was one of the youngest men to possess his Master of Sail Certificate.

In the 1914-18 War he served as a gunner, later obtaining a commission. On demobilization he was articled to Mr. C. H. Kempthorne, of Cardiff, and remained with him until 1937, when he commenced practice on his own account. In the last War he served in the Royal Engineers, retiring owing to ill-health, in 1944, with the rank of Major. He joined Mr. Gordon H. Griffiths [*F*], of 67 Queen Street, Cardiff, in 1945, and together they carried out large and important commissions in South Wales. Mr. Hayes recommenced practice on his own account in January of this year.

A member of the Council of the South Wales Institute of Architects for many years, he was always ready to help a brother architect, and took a great interest in the careers of younger members of the Institute.

Notes from the Minutes of the Council

MEETING HELD WEDNESDAY 6 JULY 1949

Appointments

(A) National Consultative Council of the Building and Civil Engineering Industries: R.I.B.A. Representatives for year ending 30 June 1950: Mr. Michael Waterhouse (President) and Mr. T. Cecil Howitt [*F*] re-appointed.

(B) Council of the British School at Rome: R.I.B.A. Representatives: Mr. Martin S. Briggs [*F*] re-appointed for further term of three years. The second representative is Mr. A. B. Knapp-Fisher [*F*].

(C) Regional Advisory Council for Higher Technological Education: R.I.B.A. Representative for London and Home Counties: Mr. J. K. Hicks [*F*] re-appointed.

(D) B.S.I. Committee B/77 Refuse Chutes for Use in Multi-Storey Flats: R.I.B.A. Representative: Mr. E. S. Ambrose [*F*].

Election of Vice-Presidents, Honorary Secretary and Honorary Treasurer: Mr. C. H. Aslin [*F*], Mr. A. W. Kenyon [*F*] and Mr. A. B. Knapp-Fisher [*F*] were re-elected Vice-Presidents for the Session 1949-50. Mr. A. Graham Henderson [*F*], as Chairman of the Allied Societies' Conference, became a Vice-President under the provisions of Bye-law 28.

Mr. A. L. Roberts [*F*] was re-elected Honorary Secretary and Mr. John L. Denman [*F*] was re-elected Honorary Treasurer.

New Members of Council and Retired Members of Council: The President welcomed new members of Council, and on his proposition a vote of sincere appreciation of the services of those members who had retired since the last meeting was passed.

Appointment of Committees: The Council appointed committees for the Session 1949-50.

British Architects' Conference 1949: Nottingham: A hearty vote of thanks was passed in favour of the President and Council of the Nottingham, Derby and Lincoln Architectural Society and all those who had offered hospitality and otherwise contributed to the success of the recent conference in Nottingham.

R.I.B.A. Architecture Bronze Medal: New South Wales Chapter, Royal Australian Institute of Architects: Formal approval was given to the recommendation of the jury of the New South Wales Chapter, R.A.I.A., that the R.I.B.A. Architecture Bronze Medal for the period of eleven years ending 31 December 1947 be awarded in favour of the Orient Line Building, Spring Street, Sydney, N.S.W., designed by Messrs. Fowell, McConnell and Mansfield [*F/F*], in association with Mr. Brian O'Rorke [*F*].

R.I.B.A. Drawings Collection: On the recommendation of the Library Committee it was agreed to invite each Royal Gold Medallist to present or bequeath one or two of his original drawings to the Library collection.

Junior Organization. The Council considered a further report from the special committee under the chairmanship of Mr. A. B. Knapp-Fisher [*F*], on Junior Organization. In accordance with the reference given at the Council meeting on 8 February the committee had drafted a tentative framework for a decentralized organization, but had suggested as a first step that the views of Schools and Allied Societies and students in the provinces should be considered as to the desirability of such an organization.

It was agreed that further discussions with the Architectural Students' Association should not be pursued and that schools and Allied Societies should be asked for their views on a loose and decentralized organization.

Special Scales of Fees: The Council approved and confirmed the action taken by the Practice Committee in agreeing scales of fees with the War Office for the Layout of Married Quarters; and with the London County Council for large schools.

Membership: The following members were elected: as Fellows, 3; as Associates, 2; as Licentiate, 1. Students: 24 Probationers were elected as Students.

Applications for Election: Applications for election were approved as follows: *Election* 11 *October* 1949: as Fellow, 1; as Associates, 14; as Licentiates, 14. *Election* 1 *November* 1949 (*Overseas Candidates*): as Fellow, 1; as Associates, 7.

Applications for Reinstatement: The following applications were approved: as Associates: Neil McMartin Stewart, Ernest Charles Turner; as Licentiates, Christopher Ronald Cooper, Ronald Leslie Hills.

Resignation: The following resignation was accepted with regret: Frederick Waterman [*A*].

Obituary: The Secretary reported with regret the death of the following members: Alfred William Blomfield [*A*], Edwin Francis Reynolds [*F*]—Mr. Reynolds was Soane Medallist 1903—William John Roberts, O.B.E. [*A*]—Mr. Roberts was Ashpitel Prizeman 1909—Harry Horton [*L*], Arthur Stewart Wood [*Retd. L*]. By resolution of the Council the sympathy and condolences of the Royal Institute have been conveyed to their relatives.

Membership List

ELECTION: 6 JULY 1949

The following candidates for membership were elected on 6 July 1949:

AS FELLOWS (3)

Bloomfield: Frank I'Anson [*A* 1920], Sydney, N.S.W.

Pastakia: Rustom Hormusji [*A* 1938], Bombay.

and the following Licentiate, who has passed the qualifying Examination:

Causton: Thomas William, Lagos.

AS ASSOCIATES (2)

The name of a school, or schools, after a candidate's name indicates the passing of a recognized course.

Hall: Reuter Louis Hallam, North Balwyn, Australia.

Starkey: William John, B.Arch., Mosman, N.S.W.

AS LICENTIATE (1)

Barrett: Leslie Daniels, Cairo.

Members' Column

This column is reserved for notices of changes of address, partnership and partnerships vacant or wanted, practices for sale or wanted, office accommodation, and personal notices other than for posts wanted as salaried assistants for which the Institute's Employment Register is maintained.

APPOINTMENTS

Mr. George R. Bruce, A.M.T.P.I. [*A*], has been appointed County Architect for Cardiganshire. His address will be County Hall, Aberayron, Cardiganshire.

Mr. T. R. Gibson, A.M.T.P.I. [*A*], was appointed Senior Town Planner for Canberra, Australian Capital Territory, on 5 May. His private address is Block 15, Section 47, Turner, Canberra, A.C.T., Australia.

Mr. R. W. Hewison, A.M.T.P.I. [*A*], sailed for Sydney, Australia, on 8 July to take up an appointment as Planning Officer with the New South Wales Government.

Mr. H. Judson [*A*] has resigned his position as Senior Assistant Architect with the Kent County Council, and has taken up an appointment as a chief or sectional architect with the County Council of the West Riding of Yorkshire. His new office address is the County Architect's Department, County Hall, Wakefield, Yorkshire.

Mr. Rolf Koren [*A*] has been appointed Assistant Architect to the Singapore Improvement Trust as from 1 July. His new address will be the Singapore Improvement Trust, Municipal Buildings, Singapore.

Mr. S. Morrison [*A*] has resigned his appointment as Principal Assistant Architect to the Hertfordshire County Council, and has commenced practice at 'Derwent House', 39 Full Street, Derby (Becketwell 48670), where he will be pleased to receive trade catalogues etc.

Mr. G. W. Pollard [*A*] has taken up an appointment as Senior Architect, Director of Works and Services (Middle East), Ministry of Works, British Embassy, Cairo. He will be pleased to receive trade catalogues etc.

PRACTICES AND PARTNERSHIPS

Mr. J. R. Anderson [*F*] is now in practice at York House (First Floor), Stanley Avenue, Salisbury, Southern Rhodesia, and will be pleased to receive trade catalogues etc.

Mr. A. Heslop Antrum [*A*] would be pleased to receive trade catalogues at 31 Addison Road, Kensington, W.14. (WEStern 1134.)

As from 24 June, **Mr. Peter Berner** [*A*] ceased to be a member of the firm of **W. A. Bassett and Peter Berner. Mr. W. A. Bassett** [*L*] is carrying on the practice in his own name at 23 Quarry Hill Road, Tonbridge.

Messrs. Blackburne, Norburn and Partners [*FF L*], Nairobi and Dar-es-Salaam, have opened an office at P.O., Private Bag, Kampala, Uganda.

Mr. Michael H. Brashier [*A*] has commenced practice at 11 Gayfere Street, Westminster, London, S.W.1 (ABBey 3181), and will be pleased to receive trade catalogues etc.

Mr. R. C. Brown [*A*] has opened a practice in Salisbury, Southern Rhodesia, and will be pleased to receive trade catalogues etc. at P.O. Avondale, Marlborough, Salisbury, Southern Rhodesia.

Mr. Ronald F. Knott, A.M.T.P.I. [*A*], has commenced practice at Private Bag, Dar es Salaam, Tanganyika, E. Africa, and will be pleased to receive trade catalogues etc.

Mr. G. Forsyth Lawson [*L*] has taken into partnership **Mr. A. Cyril Cheek** [*A*], and will continue to practise at 30 Horse Fair, Banbury, under the style of **G. Forsyth Lawson and A. Cyril Cheek** [*L A*].

Mr. Ivor Shaw [*F*], who is a partner with **Mr. S. John Lloyd** [*A*] in the firm of **Shaw and Lloyd,** 74 Great Russell Street, Bloomsbury Square, London, W.C.1, will shortly be leaving England to take up residence in Tel-Aviv, where the partnership has opened an office at 47 Mohilever Street, Tel-Aviv, Israel (Telephone 2776).

Messrs. Sutton and Burnett [*A A*] have taken into partnership Mr. Arthur Pearce, A.R.I.C.S., A.M.T.P.I., who has relinquished his appointment as Regional Technical Officer to the Central Land Board and War Damage Commission. Mr. Arthur Pearce will be pleased to receive trade catalogues etc. at 15 Clarendon Street, Nottingham.

Mr. Kenneth Turner [*A*] has opened an office at 43 Commercial Street, Batley, Yorkshire (Batley 567). He will be pleased to receive trade catalogues etc.

CHANGES OF ADDRESS

Mr. F. R. Barnes [*A*] has removed from 126 Uxbridge Road, Hampton, Middlesex, to c/o Messrs. Sproatt and Rolph, 1164 Bay Street, Toronto, Ontario.

Mr. Gilbert Bullimore, M.B.E. [*A*], has changed his address from 208 Bramhall Lane, Davenport, Cheshire, to Lloyds Bank Chambers, Great Underbank, Stockport (Stockport 4172).

Mr. G. A. Goldstraw [*A*] has changed his address to c/o Aycliffe Development Corporation, Aycliffe, Darlington, County Durham.

The private address of **Mr. W. H. Hallam** [*L*] is changed from 22 Ipswich Road, London, S.W.17, to 23A Ravenscroft Park, Barnet, Herts. His office continues as previously with **Messrs. T. Mortimer Burrows and Partners,** 44 Bedford Row, London, W.C.1.

The address of **Mr. Derek John Hill** [*A*], who has taken up a new appointment in Australia, is c/o Department of Works (Housing), General Post Office Buildings, Perth, Western Australia.

Mr. G. Wyville Home [*F*] has moved to Porthcuel, St. Mawes, Cornwall.

Mr. Elie Mayorcas [*F*] has moved his office to 13 David Mews, Baker Street, London, W.1 (WELbeck 1542 and WELbeck 2726), and will be pleased to receive trade catalogues etc.

Mr. J. G. Sowerby [*A*] has removed from West Hartlepool to 81 Abbey Road, Coventry.

Mr. Clifford G. Vaughan [*L*] has moved from 12 Christina Street, Swansea, to 1 St. James' Gardens, Swansea. (Swansea 55666.)

PRACTICES AND PARTNERSHIPS WANTED AND AVAILABLE

Associate (48) seeks partnership South Dorset or South Devon. Moderate capital available. Varied experience, mainly schools, domestic and commercial, in Local and Central Government Departments and previous private practice. Box 56, c/o Secretary, R.I.B.A.

Fellow wishes to purchase practice, with or without office accommodation, in London. Ample capital available. Box 66, c/o Secretary, R.I.B.A.

Third partnership for sale in old-established busy practice in South-west England. Offices in two towns. Varied practice, including hospital work. Box 64, c/o Secretary, R.I.B.A.

Associate (31) at present in London, school trained and with considerable experience of general office practice, seeks partnership or position with view thereto. Box 67, c/o Secretary, R.I.B.A.

For Sale. Well-established and growing practice in S.W. coastal town. Full particulars from Box 68, c/o Secretary, R.I.B.A.

Practice or partnerships required by two young and progressive members [*A/A*, A.M.T.P.I.] with considerable and varied experience in domestic, industrial, educational and town planning work. Box 69, c/o Secretary, R.I.B.A.

WANTED AND FOR SALE

Associate, studying for R.I.C.S. examinations, desires to purchase a copy of 'The Law relating to Building and Building Contracts' (W. T. Creswell). Box 65, c/o Secretary, R.I.B.A.

For Sale. Ellis's *Carpentry*, 2nd Edition; Ellis's *Joinery*, 3 Vols.; Mark's *Principles of Planning*, 2nd Edition; Briggs's *Architect in History* (1927); Briggs's *History of Building Crafts* (1925); Morley, *Theory of Structures* (1919). Box 63, c/o Secretary, R.I.B.A.

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